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SOME TROPICAL CUP-FUNGI

FRED J. SEAVER

(WITH PLATES 88–90)

The genus *Cookeina* was established by O. Kuntze to take the place of *Trichoscypha* of Saccardo, the latter name being untenable. A month later the genus *Pilocratera* was proposed by P. Hennings for the same reason, apparently without knowledge of Kuntze's work. The name *Pilocratera* was adopted by Lindau in Engler & Prantl's Natürlichen Pflanzenfamilien, but incorrectly so since the name proposed by Kuntze had priority. The genus is most closely allied to *Sarcoscypha* of Saccardo, but the species which are essentially tropical are probably distinct enough to be retained in a separate genus.

As the name implies, the plants are usually hairy and the hairs when present are composed of a fascicle of mycelial threads the whole tapering into a bristle-like apex. In one species, *C. Colensoi*, which is here included with the genus, the hairs are absent and the outside of the cup is clothed with granules consisting of loosely arranged cells. While well-developed hairs are wanting in this species other characters indicate a close relationship with the other members of the genus to which it undoubtedly belongs.

Another character of the genus which deserves especial mention is the peculiar markings of the spores. Three of the four species examined have striate spores. In one species, *C. insititia*, no striations were observed. However, as only one collection of this species has been seen it is possible that a further study of the species will reveal this character. The striations are not in

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the nature of thickenings or cracks such as those found in some of the Ascobolaceae but are light and dark bands extending from one end of the spore to the other but not roughening its surface, at least so far as can be determined. The width of the bands varies in different species. This character seems to be more common in tropical ascomycetes than in temperate and northern species, having also been observed by the writer in several of the tropical Hypocreales. It has also been mentioned by Doctor Thaxter in the genus *Wynnea* which genus is tropical although one species runs up into the northern United States. There may be no significance in this coincidence but it is sufficiently striking to deserve mention. All of the species examined in the present genus have either fasciculate hairs or striate spores or both; all are bright colored, more or less stipitate, of a tough consistence, grow on wood and have a similar distribution.

The genus *Phillipsia* which is treated in this paper shows a very close relationship with *Cookeina*. One species of the genus has been frequently collected in the West Indies and until recently has been filed away in our collections as an unnamed species of *Sarcoscypha*. In fact the plants very closely resemble our *Sarcoscypha coccinea*. The color of the hymenium is darker being reddish-purple instead of scarlet and the spores are unequal-sided and marked with the striations referred to in connection with *Cookeina*. The great variability in the stem and other gross characters has doubtless led to the multiplication of synonyms in this species. The genus *Phillipsia* was based on specimens in which the stem was almost wanting and had the nature of the plant been fully appreciated it is possible that the species might have been included with the preceding genus. Berkeley in describing *Peziza domingensis*, type of the genus *Phillipsia*, says,—"Though not oblique, it seems to be nearest to such species as *P. onotica*, or perhaps the two pedunculate species which follow [*Peziza Hystrix* and *Peziza Hindsii*]." This is the only reference seen which bears upon the relationship of *Phillipsia* and *Cookeina*. The striation of the spores is a character common to both genera but one which has apparently been overlooked, for it is not usually mentioned in the descriptions of any of the species of either genus except *Peziza striispora* Ellis & Everhart, which is here included as a synonym of *Cookeina Tricholoma*.

These studies are based on material in the herbarium of the Garden including numerous specimens obtained by Garden collectors in the West Indies and Mexico. The collections in several cases are accompanied by colored sketches made in the field by Mrs. Norman Taylor. These sketches show the colors to be a much brighter red than is shown in the published illustrations of the various species which must have been made from dried material or by guess from the descriptions. The photographs are made from dried material which in some cases is partially revived by wetting. On account of the tough consistence of the plants of these two genera they do not shrink a great deal in drying and the photographs compare very favorably with the drawings made from fresh material so far as the form of the cups is concerned. While these photographs do not bring out the colors they show many details which it is impossible to show even in a colored sketch. Drawings are made with the aid of a camera lucida, all spores being drawn to a common scale.

COOKEINA O. Kuntze, Rev. Gen. Pl. **2**: 849. 1891

Peziza § *Trichoscypha* Cooke, Mycogr. 252. 1879.
Trichoscypha Sacc. Syll. Fung. **8**: 160. 1889. Not *Trichoscypha* Hooker. 1862.
Pilocratera P. Henn. in Engler, Bot. Jahr. **14**: 363. 1891.

Plants stipitate or substipitate, bright-colored, some shade of red or yellow, hairy or pruinose; hairs when present fasciculate; substance tough, not shrinking much in drying; asci 8-spored; spores hyaline or subhyaline, ellipsoid to fusoid, usually striate, striations consisting of light and dark bands extending lengthwise of the spore; paraphyses present, filiform.

Type species, *Peziza Tricholoma* Mont.

KEY TO THE SPECIES

Cups clothed with well-developed hairs.
  Hairs long and conspicuous, covering the outside of the cup. *C. Tricholoma.*
  Hairs short and inconspicuous, mostly near the margin of the cup.
    Cups large, shallow; spores 27–33 × 14–18 μ. *C. sulcipes.*
    Cups small, deep; spores 40–50 × 10–12 μ. *C. insititia.*
Cups pruinose but with no well-developed hairs. *C. Colensoi.*

COOKEINA TRICHOLOMA (Mont.) O. Kuntze, Rev. Gen. Pl. **2**: 849. 1891

Peziza Tricholoma Mont. Ann. Sci. Nat. II. **2**: 77. 1834.
Peziza Hystrix Berk. Ann. Mag. Nat. Hist. II. **9**: 201. 1852.
Trichoscypha Tricholoma Sacc. Syll. Fung. **8**: 160. 1889.
Pilocratera Tricholoma P. Henn. in Engler, Bot. Jahr. **14**: 364. 1892.
Peziza striispora Ellis & Ev. Bull. Lab. Nat. Hist. State Univ. Iowa **4**: 69. 1896.
Sarcoscypha striispora Sacc. Syll. Fung. **14**: 754. 1899.

Plants stipitate, cup-shaped, with the margin slightly incurved, 1–1.5 cm. in diameter and about 1 cm. deep; stem often so short that the plants appear to be sessile or 2–3 cm. long and about 2 mm. thick, exterior of the cup as well as the stem entirely clothed with long hairs which are more numerous around the margin forming an incurved border, entire plant deep-red or nearly scarlet and a little paler outside, fading in dried plants to pale-orange; hairs often 2–3 mm. long and 100–175 μ in diameter at the base, gradually tapering toward the apex, whitish or pale-brown and composed of a dense fascicle of mycelial threads; asci cylindric, about 350–375 $\times$ 20 μ, abruptly extended below into a short appendage-like base; spores ellipsoid to fusoid, about 27–33 $\times$ 12–14 μ, hyaline or subhyaline with one or two large oil-drops and granular within, usually marked with delicate, longitudinal striations; paraphyses filiform, slender, slightly enlarged upwards.

On old wood and bark.

TYPE LOCALITY, Central America.

DISTRIBUTION: West Indies, Mexico, Central America, and Philippine Islands. Also reported from Australia and South America.

ILLUSTRATIONS: Ann. Sci. Nat. II. **2**: *pl. 4, f. 2;* Cooke, Mycogr. *pl. 51, f. 202;* Engler-Prantl, Nat. Pfl. **1**[1]: 195, *f. 155,* C-E.

Massee[1] states,—"The two species enumerated above [*Peziza sulcipes* and *Peziza Hindsii*] are synonyms of each other, and in turn both are synonymous with *Peziza tricholoma* Mont." There seems to be no doubt as to the identity of *Peziza sulcipes* and *Peziza Hindsii* but from our own studies based on material col-

[1] Jour. Linn. Soc. **31**: 507.

lected in the West Indies, *Peziza Tricholoma* Mont. appears to be distinct. The difference is shown in the accompanying photograph (plate 88).

One new synonym is here added to the list, *Peziza striispora* Ellis & Everhart. This species was described from material collected at Castillo, Nicaragua. The type could not be found in the Ellis Collection but the description, locality, etc, leave little chance for doubt as to its identity.

COOKEINA SULCIPES (Berk.) O. Kuntze, Rev. Gen. Pl. **2**: 849. 1891

Peziza sulcipes Berk. in Hooker's London Jour. Bot. II. **1**: 141. 1842.

Peziza Hindsii Berk. in Hooker's London Jour. Bot. II. **1**: 456. 1842.

?Peziza Afzelii Fries, Nov. Acta Reg. Soc. Scient. Upsal. III. **1**: 121. 1855.

Trichoscypha Hindsii Sacc. Syll. Fung. **8**: 161. 1889.

Trichoscypha sulcipes Sacc. Syll. Fung. **8**: 161. 1889.

?Trichoscypha Afzelii Sacc. Syll. Fung. **8**: 161. 1889.

Cookeina Hindsii O. Kuntze, Rev. Gen. Pl. **2**: 849. 1891.

?Cookeina Afzelii O. Kuntze, Rev. Gen. Pl. **2**: 849. 1891.

?Pilocratera Engleriana P. Henn. in Engler, Bot. Jahr. **14**: 363. 1892.

Pilocratera Hindsii Lindau, in Engler-Prantl, Nat. Pfl. **1**: 195. 1897.

Geopyxis elata Massee, Bull. Royal Gardens, Kew **1898**: 123. 1898.

Plants stipitate, cup-shaped, 1–2 cm. in diameter and about 1 cm. deep or sometimes more shallow, exterior of the cup often marked with several concentric rings near the margin and fringed with very short hairs which are more numerous at or near the margin of the cup, hymenium deep-orange to nearly scarlet, externally paler, fading to pale-yellow in dried specimens; stem often so short that the cups appear to be sessile but occasionally as long as 3 cm. and about 2 mm. thick; hairs comparatively short, subconical in form, about 400–500 μ long and 75–100 μ broad at the base gradually tapering toward the apex, composed of a dense

fascicle of mycelial threads, pale yellow; asci cylindric, about 300–350 × 20 μ with a short appendage-like stem; spores ellipsoid with the ends slightly narrowed, hyaline or subhyaline with one or two large oil-drops and granular within, 27–33 × 14–18 μ, longitudinally marked with delicate striations; paraphyses filiform, slightly enlarged above.

On old wood and bark.

TYPE LOCALITY, Surinam, South America.

DISTRIBUTION: West Indies, Mexico to South America. Also reported from Australia.

ILLUSTRATIONS: Hooker's London Jour. Bot. II. **1**: *pl. 15* (in part); Cooke, Mycogr. *pl. 51, f. 199, 200;* Cooke, Australian Fungi, *f. 153;* Engler-Prantl, Nat. Pfl. **1**[1]: 195, *f. 155, F, G;* Engler, Bot. Jahr. **14**: *pl. 6, f. 9.*

One new synonym is added to the list above, *Geopyxis elata* Massee. I have examined the type of this species and find it identical in every respect with *Peziza sulcipes* Berk. While the type of *Pilocratera Engleriana* P. Henn. has not been seen, the description fits this species very closely and it is probably the same. In describing this species Hennings emphasizes the presence of the stripes about the outer margin of the cups which is characteristic of *C. sulcipes.*

COOKEINA INSITITIA (Berk. & Curt.) O. Kuntze, Rev. Gen. Pl. **2**: 849. 1891

Peziza insititia Berk. & Curt.; Berk. & Br. Jour. Linn. Soc. **14**: 103. 1875.

Trichoscypha insititia Sacc. Syll. Fung. **8**: 161. 1889.

Plants deep cup-shaped, stipitate, cup about 5–7 mm. in diameter and of about the same depth, yellow when dry (probably much brighter when fresh), clothed about the margin with rather numerous fasciculate hairs; hairs very broad at the base, often nearly 400–500 μ and 1–2 mm. in length; stem slender, 1–2 mm. in diameter and of variable length but often attaining 1 cm.; asci cylindric, very long, often 500 × 15–18 μ; spores 1-seriate or with the ends overlapping, fusiform, filled with oil-drops and granules, curved or unequal-sided, 40–50 × 10–12 μ, subhyaline; paraphyses filiform, slightly enlarged above.

On wood.

TYPE LOCALITY: Peradeniya, Ceylon.

DISTRIBUTION: Philippine Islands, Ceylon, and Bonin Islands,

ILLUSTRATIONS: Cooke, Mycogr. *pl. 51, f. 201;* Jour. Linn. Soc. **31**: pl. 16, f. 26.

This species has not been found in the West Indies so far as known but it is not unlikely that it will be found to occur there. It is closely related to the other members of the genus but can be distinguished by the form of the cups and by differences in the spores.

Cookeina Colensoi (Berk.)

Peziza Colensoi Berk. in Hooker's Fl. New Zealand **2**: 200. 1855.
Peziza aluticolor Berk. Proc. Linn. Soc. **13**: 176. 1873.
Sarcoscypha Colensoi Sacc. Syll. Fung. **8**: 157. 1889.
Geopyxis aluticolor Sacc. Syll. Fung. **8**: 64. 1889.

Plants stipitate or substipitate, shallow cup-shaped, 1–1.5 cm. in diameter and about 5 mm. deep, dried plants pale-yellow (probably much brighter when fresh) marked with concentric rings about the outer margin, externally covered with loose cells which sometimes approach rudimentary hairs but with no well-developed hairs, wrinkled when dry especially near the base of the cup; stem very short or almost wanting, sometimes not more than 1 mm. in length, never long as in related species; asci cylindric, about 400–475 × 20 μ, gradually tapering below; spores 1-seriate or with the ends slightly overlapping, fusoid with the ends quite strongly narrowed, with one or two large oil-drops and granular within, striations consisting of several broad, longitudinal bands extending the length of the spore, 30–40 × 12–15 μ; paraphyses filiform, scarcely enlarged above.

On wood and bark.

TYPE LOCALITY: New Zealand.

DISTRIBUTION: West Indies, New Zealand, Australia, and Africa.

ILLUSTRATIONS: Hooker's Fl. New Zealand **2**: *pl. 105, f. 5;* Cooke, Mycogr. *pl. 50, f. 198.*

The plants of this species examined are almost sessile although the species is often described and illustrated with a stem several mm. long. The stem is probably variable as in other species of the genus although it has never been found to attain the length characteristic of other species of the genus. With the exception

of the shorter stem, and absence of hairs the cups of this species might easily be mistaken for a subsessile form of *Cookeina sulcipes*. The spores however are quite different. *Geopyxis Mölderiana* P. Henn.[2] does not seem to differ materially from this species so far as can be judged from the published description.

PHILLIPSIA Berk. Jour. Linn. Soc. **18**: 388. 1881

Plants attached to the substratum by a very broad base which is often extended into a rather long, thick stem, hymenium bright-colored; substance tough, not shrinking much in drying; asci 8-spored; spores usually striate, subhyaline; paraphyses present, very slender.

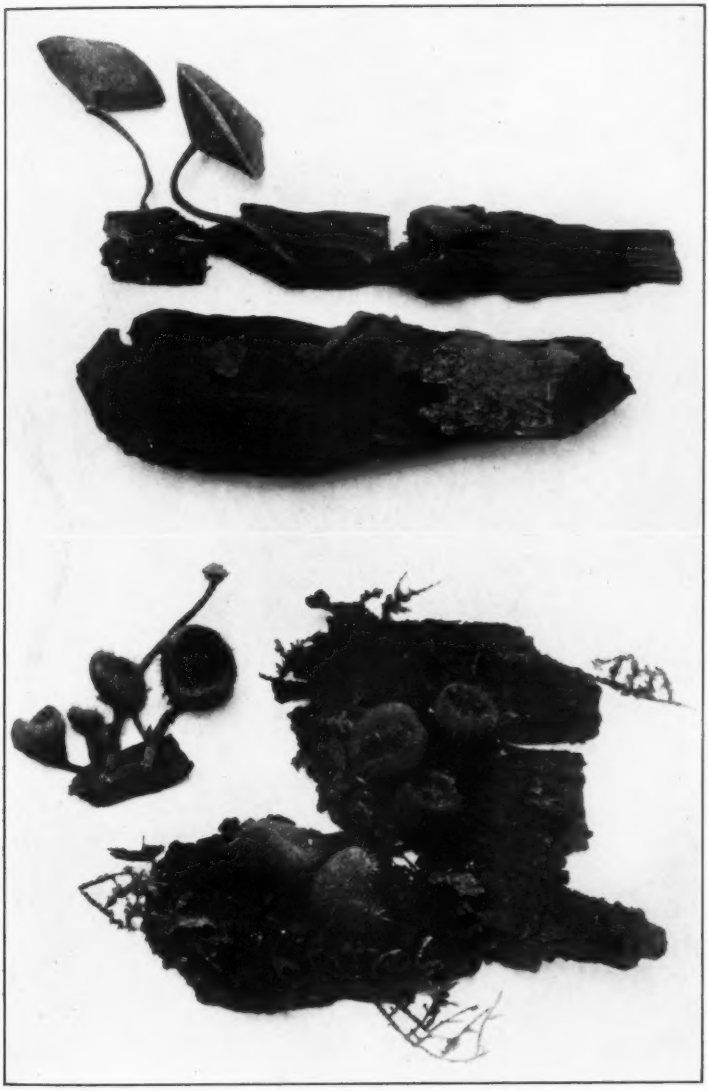
TYPE SPECIES, *Peziza domingensis* Berk.

PHILLIPSIA DOMINGENSIS Berk.

Peziza domingensis Berk. Ann. Mag. Nat. Hist. II. **9**: 201. 1852.
Peziza crispata Berk. & Br. Jour. Linn. Soc. **10**: 367. 1869.
Helotium purpuratum Kalchbr. in de Thümen, Myc. univ. 1614. 1880.
?Peziza Harmoge Berk. & Br. Jour. Linn. Soc. **14**: 104. 1875.
Phillipsia kermesina Kalchbr. & Cooke, Grevillea **9**: 25. 1880.
Phillipsia subpurpurea Berk. & Br. Jour. Linn. Soc. **14**: 104. 1875.
Lachnea crispata Sacc. Syll. Fung. **8**: 682. 1889.
Otidea domingensis Sacc. Syll. Fung. **8**: 97. 1889.

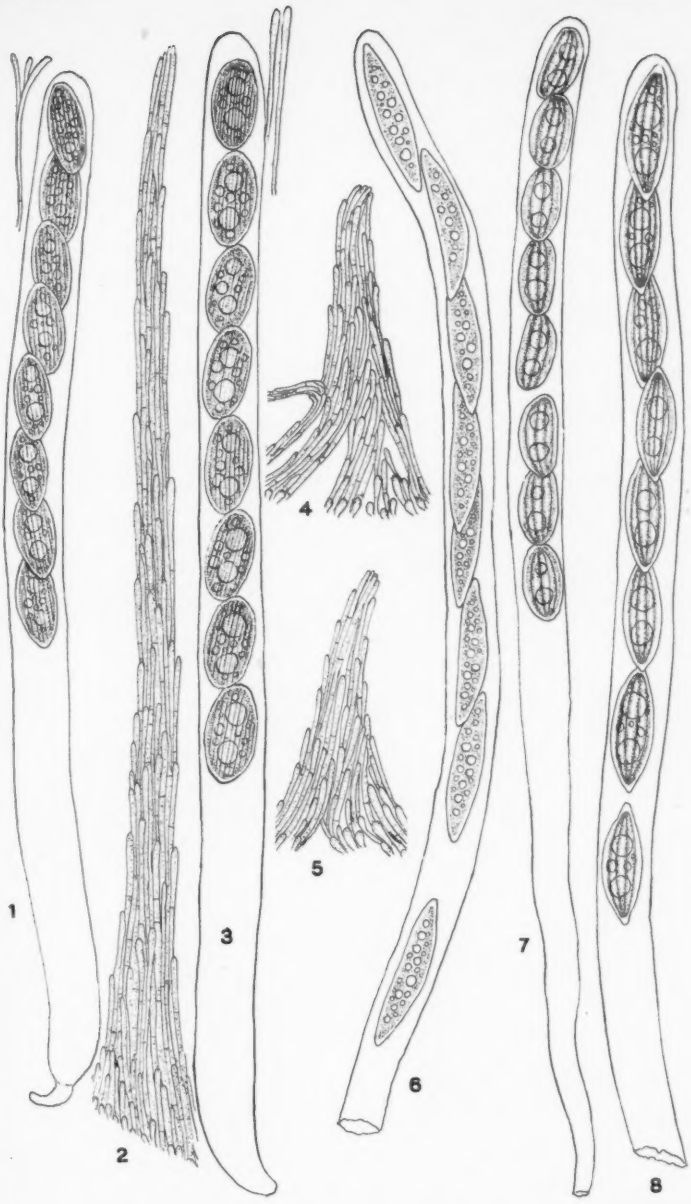
Plants shallow cup-shaped, regular or occasionally unequal-sided, attached by a broad base, sometimes nearly as broad as the cup, base often extended into a thickened stem 1 cm. long, hymenium dark reddish-purple, externally much paler, nearly white or with a pinkish tinge or fading to a dirty-yellow in dried plants, more or less downy especially near the base; substance tough and corky in dried plants, hymenium becoming pitted as a result of unequal shrinkage in drying, often giving it the appearance of a resupinate polypore; asci cylindric, about 300–360 × 15–20 μ, gradually tapering below into a long stem-like base; spores 1-seriate or with the ends slightly overlapping, ellipsoid, ends very blunt or more rarely abruptly narrowed, unequal-sided, striated, striations consisting of a few broad bands extending the length

[2] Hedwigia **41**: 30. 1902.



COOKEINA SULCIPES (Berk.) O. Kuntze
COOKEINA TRICHOLOMA (Mont.) O. Kuntze

COOKEINA COLENSOI (Berk.) Seaver
COOKEINA INSITITIA (Berk. & Curt.) O. Kuntze
PHILLIPSIA DOMINGENSIS Berk.



1, 2. COOKEINA TRICHOLOMA (Mont.) O. Kuntze; 3–5. COOKEINA SULCIPES (Berk.) O. Kuntze; 6. COOKEINA INSITITIA (Berk. & Curt.) O. Kuntze; 7. PHILLIPSIA DOMINGENSIS Berk.; 8. COOKEINA COLENSOI (Berk.) Seaver

of the spore, with one or two large oil-drops and often several smaller ones, subhyaline; paraphyses filiform, slightly enlarged at their apices.

On old wood and bark.

TYPE LOCALITY: Santo Domingo.

DISTRIBUTION: West Indies, Australia, and Africa.

ILLUSTRATIONS: Cooke, Australian Fungi, *pl. 191, f. 151;* Grevillea **9**: *pl. 136, f. 21;* Jour. Linn. Soc. **31**: *pl. 16, f. 7, 8 and 9.*

The above are some of the synonyms of this species, which have probably resulted from the great variability of the plants. It is not unlikely that further study of tropical discomycetes will add still other synonyms to the list.

EXPLANATION OF PLATES

PLATE LXXXVIII

Cookeina sulcipes (Berk.) O. Kuntze (upper figure).
Cookeina Tricholoma (Mont.) O. Kuntze (lower figure).

PLATE LXXXIX

Cookeina Colensoi (Berk.) Seaver (upper figure).
Cookeina insititia (Berk. & Curt.) O. Kuntze (middle figure).
Phillipsia domiggensis Berk. (lower figure).

PLATE XC

1. *Cookeina Tricholoma;* ascus, spores and paraphyses.
2. *Cookeina Tricholoma;* hair from outside of cup.
3. *Cookeina sulcipes;* ascus, spores and paraphyses.
4 and 5. *Cookeina sulcipes;* hairs from outside of cup.
6. *Cookeina insititia;* ascus and spores.
7. *Phillipsia domingensis;* ascus and spores.
8. *Cookeina Colensoi;* ascus and spores.

NEW YORK BOTANICAL GARDEN.

TYPE STUDIES IN THE HYDNACEAE[1]— V. THE GENUS HYDNELLUM.

HOWARD J. BANKER

Hydnellum Diabolus sp. nov.

Hydnum carbunculus (Secr.) Banker, Mem. Torrey Club **12**: 151. 1906; not *Hydnum carbunculus* Secr., Myc. Suis. **2**: 515. 1833.

Hymenophore terrestrial, mesopodous, gregarious, more or less confluent, low, nearly sessile, broad; pileus convex to plane, rarely slightly depressed in center, more or less uneven, somewhat round to irregular, 4–10 cm. wide and by confluence often 20 cm. wide; surface wooly pubescent, often more or less floccose squamulose, azonate, whitish at first turning slightly brownish with irregular blotches of dark-brown to nearly black where bruised, these latter spots more or less glabrous, shining, probably from the dried juice; substance fibrous, tough, spongy, grayish-brown in the upper part of the pileus, compact, hard, somewhat woody, more or less distinctly zonate in the lower part, exuding a thick red juice in the fresh plant; margin somewhat thick, obtuse, subfertile to sterile; stem stout, very short, deformed, becoming bulbous in the substratum, and sometimes subradicating, 1–3 cm. wide, 1 mm. to 1 cm. long above ground; teeth slender, terete, tapering, acute, decurrent, pinkish white, less than 5 mm. long shortening to the margin, about 3–5 to a sq. mm.; spores ovoid, tuberculate, brownish, 4–5.5 μ wide; hyphae of pileus hyaline, smooth, thin-walled, collapsing when dried, recovering quickly in KOH, forming a somewhat intricate tangle but with a decided tendency to run longitudinally, separable in KOH, septate with simple clamp-connections, segments extremely long, slender, uniform, 3–4 μ wide, branching diffuse; odor of hickory nuts, strong; taste intensely acrid.

On the ground under conifers in autumn.

The type specimen of this species was collected at Mt. Desert,

[1] Investigation prosecuted with the aid of a grant from the Esther Herrman Research Fund of the New York Academy of Science.

Maine, by Miss V. S. White, No. 148, and deposited in the herbarium of the New York Botanical Garden. The species is found distributed more or less sparingly from Maine to Alabama. The following specimens appear to belong here: Maine, *White;* New Jersey, *Ellis;* Maryland, *Shear;* Alabama, *Earle.* The species is also represented by many of the specimens in the following exsiccati under the name *Hydnum ferrugineum* Fries: Ellis, N. Am. Fung. 928; and Shear, Ell. and Everh. Fung. Columb. Cont. 1409.

In our previous paper, *loc. cit.*, we identified our American plants with Secretan's species solely on the basis of his description. The type of *H. carbunculus* Secr. has not been located and probably is not in existence. No specimens were found in European herbaria referred to his species, and it seems probable that the name is not there recognized as anything more than a synonym of *H. ferrugineum* Fries Secretan himself evidently regarded his species as the same as *H. ferrugineum* Fries and proposed the name on the ground that Fries's name was preoccupied by *H. ferrugineum* Pers. His description, however, does not accord well with authentic specimens of the Friesian species, but does apply well to our American plants.

On the other hand, our plants appear to be entirely distinct from any European forms, as but one doubtful specimen was found in Europe that seemed to show any affinity with the American species. That was a specimen at Upsala received from Karsten and referred to *H. ferrugineum* Fries but was evidently quite different from authentic specimens of that species in the same herbarium. It was not, however, any nearer to our American forms. A specimen from Bresadola in the New York Botanical Garden Herbarium and referred by him to *H. ferrugineum* Fries also somewhat approaches in appearance the American plants but is clearly not the same.

Although Secretan's description is admirably adapted to our American forms, it seems best to treat the American segregation as a distinct species for which we now propose a specific name. Our grounds for this decision are: first, the fact that both by himself as well as by other European mycologists Secretan's species was regarded as equivalent to *H. ferrugineum* Fries; second,

this fact combined with the lack of any specific type is sure to involve any forms referred to Secretan's species in confusion with the Friesian species; third, the Friesian species itself, as we believe, is of doubtful standing and further confusion is likely to be involved with its synonyms; finally, the American form does not appear to be represented in Europe and there is, therefore, reason for serious doubt if Secretan really described the American species.

HYDNELLUM VELUTINUM (Fries) Karst. Medd. Soc. Faun. et Flora Fenn. **5**: — (*27*). 1879

Hydnum velutinum Fries, Sys. Myc. **1**: 404. 1821.
Hydnum spongiosipes Peck, Ann. Rept. N. Y. State Mus. **50**: 111. 1897.

No specimen whatever referred to *Hydnum velutinum* Fries was found at Upsala. There is probably, therefore, no type specimen of this species. At Berlin no specimens were found under this name except a couple of American plants sent by Atkinson. At Paris, besides a specimen from Massachusetts collected by Sprague, there was only one other specimen which had been collected in "Nantes." At Kew, England, a considerable number of specimens were found under this name, many of which were identical with the American *H. spongiosipes* Pk. as were also the specimens at Berlin and Paris. The latter species is, therefore, evidently a European species though apparently rare on the continent and is known to the European mycologists as *Hydnum velutinum* Fries with the description of which it fully accords.

HYDNELLUM SCROBICULATUM (Fries) Karsten, Medd. Soc. Faun. et Fl. Fenn. **5**: — (*27*). 1879

Hydnum scrobiculatum Fries, Obs. Myc. **1**: 143. 1815.
Hydnum ferrugineum Fries, Obs. Myc. **1**: 133. 1815; not *H. ferrugineum* Pers. Tent. disp. Meth. Fung. 30. 1797.
Hydnellum sanguinarium Banker, Mem. Torrey Club **12**: 152. 1906.

No type specimen of *Hydnum scrobiculatum* Fries was to be found in the herbarium of Fries at Upsala. Plants referred to this

species at Upsala as well as in most other European herbaria are quite variable and show the usual confusion with the closely related species. In general, however, the interpretation of the species by European mycologists appears to be identical with that set forth by the writer in a former paper.[2]

Hydnum ferrugineum Fries as represented at Upsala by specimens of as early a date as 1849 and 1866 does not appear to differ essentially from many of the specimens also there referred to *H. scrobiculatum*. These forms, however, we would refer to *H. hybridum* Bull. Fries himself in the Systema Mycologicum **1**: 403 cites *H. hybridum* Bull. as a synonym, but later in the Epicrisis Systematis Mycologici he identified Bulliard's species with his own *H. velutinum* with the emphatic remark "Omnino hoc." A study of Fries's descriptions of *H. ferrugineum* conveys the impression of changing conceptions. In the Observationes Mycologici **1**: 133 where the original description is found the species does not appear to differ greatly from our conception of *H. velutinum*. In the Systema Mycologicum *l. c.* the description is far more applicable to the forms which we have regarded as *H. scrobiculatum*. His figure in the Icones Selectae Hymenomycetes *pl. 5. f. 1*, is an excellent representation of what we regard as *H. scrobiculatum*. As to the red juice of which much has been made in later years we do not believe it to be a constant character as we have seen plants that appeared to differ in no other way with clear watery juice, with juice of a pinkish tinge, and with juice that the collector stated was "blood red."

On the basis of the specimens at Upsala, the determination of which from their early date may be regarded as approved by Fries, one would perhaps be justified in treating *H. ferrugineum* Fries as a synonym of *H. hybridum* Bull. but the plants do not accord well with the descriptions and figures. It is perhaps fortunate that *H. ferrugineum* Fries is untenable and that the name must be treated as a synonym, but it is difficult to decide whether it is better regarded as a synonym of *H. scrobiculatum* Fries or of *H. hybridum* Bull. On the whole, we incline to the view that it pertains to the former.

[2] Mem. Torrey Club **12**: 156. 1906.

Hydnellum sanguinarium Banker was proposed as a substitute for the untenable *Hydnum ferrugineum* Fries at a time when we regarded the red juice as having much weight in the separation of species. As treated by us in the work cited it differs in no other essential particulars from our treatment of *H. scrobiculatum* Fries.

Hydnellum hybridum (Bull.)

Hydnum hybridum Bull. Hist. Champ. Fr. 307. 1791.
Hydnum Queletii Fries, Quél. Champ. Jura Vosg. 277. 1872.

There is no type of *H. hybridum* Bull. in existence and our forms are referred here solely on the basis of Bulliard's description and figures. The radiating rugae appear to be the most characteristic feature of the segregation. This character, however, is sometimes obscure and it is then difficult to distinguish the plants from *H. scrobiculatum*.

The type of *H. Queletii* is preserved in the herbarium at Upsala and is a typical specimen of the segregation which we refer to *H. hybridum* Bull., having the radiate rugae especially well developed. The plants of this segregation have been quite commonly referred to *H. scrobiculatum* by the most eminent mycologists, often to *H. zonatum* Batsch, and even apparently by Fries himself to *H. ferrugineum* Fries.

Hydnellum Vespertilio (Berk.)

Hydnum Vespertilio Berkeley, Hooker's Jour. Bot. and Kew Gard. Miscel. **6**: 167. 1854.

In the original description of this species Berkeley emphasized the fact that it was black and suggested a possible relationship to *Hydnum nigrum* Fries. This was misleading and, as the description was based on specimens from India and suggested no American forms, little attention was paid to it. In searching through the Berkeley Herbarium at Kew, however, specimens were found marked according to notes taken at the time "Hydnum vespertilio, Berk. Nunklow July 10, 1860." These specimens were at once recognized as similar to certain undetermined American forms belonging in the genus *Hydnellum*. They are undoubtedly the type of Berkeley's species as that author cites for his type

specimens "Nunklow. July 10, 1850." At the time of taking my notes I doubtless mistook the 5 in the year date for a 6 and just then I had no reference to Berkeley's original description for comparison.

The specimens at Kew although very dark are not black and are clearly typical examples of the genus *Hydnellum*, being very near *H. hybridum* and *H. zonatum*. The American forms that belong here have been, doubtless, generally referred to *H. zonatum*. Berkeley's description fits our plants in every respect except for his unqualified statement that the species is black. Fresh living plants have the usual cinnamon-brown color of the related species, sometimes uniform, occasionally with the pink border characteristic of *H. zonatum*. One of the most distinctive features is the rows of scabrous, yellow dots that mark the zonations of the pileus. Old specimens are very dark and the writer has in his herbarium a collection gathered at Bolton, N. Y., that contains one or two old and apparently weathered specimens that are actually black. Nothing so dark was observed in the material at Kew, and we believe that the character pertains only to old dead specimens.

HYDNELLUM ZONATUM (Batsch) Karst. Medd. Soc. Faun. et Fl. Fenn. **5**: — (27). 1879

Hydnum zonatum Batsch, Elench. Fung. 111. 1783.
Hydnum concrescens Pers. Obs. Myc. **1**: 74. 1796.

There is no type specimen of *Hydnum zonatum* Batsch and our conception of the species is almost wholly dependent upon Batsch's description and figures.

In Persoon's herbarium at Leyden there are a number of specimens under the names *Hydnum concrescens* Pers. and *Hydnum cyathiforme* Bull. which are there treated as synonymous. None of these are probably to be regarded as type specimens although most of them may be considered as having their determination approved by Persoon. The principal set of these appears to be identical with the forms which we have referred to *H. concrescens* Pers.[3] Most of the other specimens are forms which we would refer to *H. hybridum* Bull. In the European

[3] Mem. Torrey Club **12**: 157.

herbaria referred the forms generally to *H. zonatum* Batsch are of these two types.

The American form which we have previously referred to this species we are now convinced is not a European plant. Nothing like it has been observed in any of the European collections. We, therefore, return to the prevailing view of the European mycologists and regard *H. zonatum* Batsch as synonymous with *H. concrescens* Pers. It is highly probable that *H. cyathiforme* Bull. should be regarded as of this segregation. At Paris, specimens from Desmaziéres are strictly of this type and are ascribed in common to *Hydnum cyathiforme* Bull., *H. concrescens* Pers., and *H. zonatum* Batsch.

Hydnellum parvum sp. nov.

Hymenophore terrestrial, mesopodous, gregarious, often confluent, small, cinnamon-brown with light margin; pileus subconvex to plane, umbilicate, or subinfundibuliform, irregular, thin, less than 1 mm. thick, 1.5–3 cm. wide; surface radiately fibrillose-striate, subpubescent, distinctly zonate with shades of brown, darker in the center, pink to nearly white toward the margin when fresh, but turning more or less uniform brown when dried; margin thin, acute, repand, more or less lacerate; substance darker and more compact than surface layer, azonate, thin; stem slender, subcylindrical, slightly bulbous at base with scarcely evident spongy tomentum, solid, pubescent, cinnamon-brown, 1–1.5 cm. long, 2–3 mm. wide; teeth slender, terete, tapering, acute, not decurrent, dark-brown, less than 1.25 mm. long, shortening towards margin and stem; spores subglobose, coarsely tuberculate, 3–4 μ wide, brown; hyphae colored brownish, transparent, smooth, somewhat thin-walled, collapsing when dried, recovering but partially in KOH, running distinctly longitudinally and interweaving into a compact layer, separable with difficulty in KOH, septate without clamp-connections, segments extremely long, slender, uniform in width, 3–4 μ wide, branches few, arising at a point about once or twice the width of the hypha below a septum and septate at about three or four times the width of the hypha above its origin.

On ground in dry woods, usually under conifers, in late autumn.

The type specimens were collected by Dr. L. M. Underwood in Alabama and are in the Underwood herbarium at Columbia University.

In a former work[4] these plants were referred to *Hydnellum zonatum* (Batsch) Karst. under a mistaken conception of that species which we have now corrected (see *H. zonatum* above). After a thorough search through a number of the most important European herbaria, we are convinced that the plants are not European forms and should be recognized as a distinct species. The plants do not appear to be common but have a wide distribution, specimens having been seen from New York, Alabama, and Michigan.

HYDNELLUM SUAVEOLENS (Scop.) Karst. Medd. Soc. Faun. et Fl. Fenn **5**: 27. 1879

Hydnum suaveolens Scopoli, Fl. Carn. **2**: 472. 1772.
Hydnum compactum Pers. Comm. Schaeff. 57. 1800.
Hydnum boreale Banker; White, Bull. Torr. Club **29**: 553. 1902.

There is no type specimen of Scopoli's species, but specimens in Europe referred here are generally of the same type as the forms previously described by the writer[5] under this name.

Hydnum compactum Pers. is represented in the Persoon herbarium at Leyden by several specimens some of which are labelled in Persoon's own hand. They do not appear to differ in any respect from the forms usually referred to *H. suaveolens* Scop.

The blue coloration of *H. suaveolens* appears to be quite variable in intensity and doubtless tends to fade with age. In old herbarium specimens it is usually faint. The odor likewise seems to vary in intensity and is probably sometimes nearly, if not wholly, lacking. While in some specimens it can be detected for years in most old herbarium specimens it has evidently disappeared. In the original description of *H. boreale* Banker, the odor was stated as unpleasant on the authority of Miss White's field notes. The odor of these plants is generally described as that of melilot. Such an odor if very strong would probably be unpleasant to some people.

Hydnellum Rickerii sp. nov.

Hymenophore terrestrial, mesopodous, scattered, or solitary, medium to large sized, dingy-brown or olivaceous; pileus depressed

[4] Mem. Torrey Club **12**: 158. 1906.
[5] Mem. Torrey Club **12**: 163. 1906.

to subinfundibuliform, repand, somewhat uneven or rugose, round to slightly irregular, 12–20 cm. wide; surface glabrous, pelliculose, subrugose, dark-dingy-olive-brown near center to chestnut near margin, the coloring somewhat irregularly distributed; margin thin, incurved when dried; substance fibrous to subfleshy, thin, 2–4 mm. thick when dried, dingy-white or slightly tawny with a gradually increasing steel-blue toward center and in stem, homogeneous, azonate; stem short, excentric, with bulbous base; teeth slender, terete, subcylindrical, acute, decurrent, grayish-brown, 7 mm. or less long, shortening toward margin and stem, crowded, 7–9 to a sq. mm.; spores globose to ovoid, tuberculate, pale-brown to hyaline, 3–4 μ wide; hyphae of the pileus hyaline to pale-yellowish, smooth, thin-walled, collapsing when dried, recovering quickly in KOH, running longitudinally but interweaving into a close tangle, separable in KOH with some difficulty, rarely septate with simple clamp-connections, segments extremely long, slender, uniform, 5–6 μ wide, scarcely any branching; odor very strong aromatic with a suggestion of melilot.

The type specimen was collected in Orono, Maine, by P. L. Ricker, No. 173, and is in the writer's herbarium. Part of the same collection is in Mr. Ricker's possession and I believe a specimen is with Prof. Farlow at Harvard University.

While the species approaches *H. suaveolens* in several particulars it differs conspicuously in the darker color of the pileus, the character of the substance which is more nearly fleshy and does not dry hard and woody as in *suaveolens*, and the fragrant, spicy odor. The odor of this plant is the most remarkable of that of any fungus I have seen. It has something of a suggestion of melilot, but the heavy sickening odor of the latter is relieved by a spicy, aromatic quality which makes the fragrance of this plant especially delightful. Two specimens of this plant filled a large laboratory with their odor for many weeks and even after twelve years a fragment of one of these plants still gives a distinct though faint odor. The species is known only from the original collection.

Hydnellum inquinatum sp. nov.

Hymenophore terrestrial, mesopodous, gregarious to confluent, light or dark-brown with light border, medium to large sized; pileus obconic, plane to depressed or subinfundibuliform, somewhat round or elliptical, 5–10 cm. wide, 0.4–1 cm. thick; surface

somewhat uneven, sometimes wrinkled or irregularly corrugated, central portion of disk brownish to dark-brown becoming blackish with age, glabrous or subpubescent, sometimes pelliculose, with a more or less distinct border of whitish or isabelline wooly pubescence 1–2 cm. wide; margin obtuse, entire, substerile; substance in two layers, an upper spongy layer thickest at center and thinning out toward margin, and a lower hard, woody layer extending into and forming the core of the stem, sometimes transversely zonate, light-brown to pallid, hygrophanous, juice watery, colorless; stem central or excentric, short, with a spongy bulbous base, surface more or less uneven, dark-brown to blackish, subpubescent, 1–3 cm. long including the bulbous base, 0.7–1 cm. wide; teeth stout, somewhat compressed, often forked, obtuse to acute, shortening uniformily toward stem and margin, decurrent to the bulbous base, dark-gray-brown at base, lighter toward tip, 5 mm. or less long, 0.1 mm. wide, 6–8 to a sq. mm.; spores brown or fuscous, ovoid, coarsely tuberculate, $4 \times 5\,\mu$ wide; hyphae in the compact portions hyaline, smooth, somewhat thin-walled, collapsing when dried, recovering quickly in KOH, running longitudinally and interwoven, somewhat easily separable in KOH, septate with simple clamp-connections, segments extremely long, slender, uniform, with many guttulae, $4–5\,\mu$ wide, branching diffuse, both filaments septate a little above origin of branch, but only main filament with clamp-connection; in spongy portions hyphae thin-walled, collapsing and not recovering much in KOH, forming an intricate tangle and not separating easily in KOH, septate without clamp-connections and without guttulae, in other respects as the former; odor pleasant somewhat farinaceous, not strong; taste mild.

On ground under hemlocks, in late summer.

The type specimens were collected by the writer near Bolton, N. Y., and are in his herbarium. Specimens of what appear to be the same have been seen from New York, *Underwood*, and from New Hampshire, *Wilson*.

Hydnellum Peckii sp. nov.

Hymenophore terrestrial, mesopodous, gregarious to subconfluent, whitish to brownish gray, small to medium sized; pileus subobconic, plane to depressed, inclined, somewhat round to irregular, 2–5 cm. wide, 2–5 mm. thick; surface uneven, whitish pubescent when young, becoming glabrous and brownish-gray extending from the center finally to the margin; margin thin, acute,

substerile, curling, uneven; substance tough, fibrous, compact, somewhat woody when dry, sometimes with a little spongy layer above at center, light-brown or isabelline; stem central, short, tapering downward into a spongy bulbous base, uneven, pubescent, dark-brownish, about 0.5 cm. long, 4–8 mm. wide, the bulbous base 1–1.5 cm. wide by 2–2.5 cm. long; teeth slender, terete, tapering, acute, shortening uniformly toward stem and margin, dark gray-brown at base, lighter at tip, 3 mm. or less long, 0.25–0.35 mm. wide, 7–9 to a sq. mm.; spores brown or fuscous, slightly tuberculate or angular, subglobose to ovoid, 4–5 μ wide; hyphae hyaline, smooth, somewhat thin-walled, collapsing when dried, recovering quickly in KOH, running longitudinally in compact portion and forming an intricate tangle in spongy portion, easily separable in KOH, slender, uniform, septate with simple clamp-connections, segments extremely long, 3.5–4 μ wide, branching diffuse, both filaments septate, with or without clamp-connections a little above origin.

On ground in woods, in autumn.

The type specimens were collected at North Elba, N. Y., by C. H. Peck, state botanist of New York, after whom the species is named. The specimens are in the writer's herbarium and a portion of the same collection is in the New York state herbarium at Albany. The species is not known outside of the original collection.

Hydnellum geogenium (Fries)[6]

Hydnum geogenium Fries, Ofv. Kongl. Vet. Ak. Forh. **1852**: 127. 1852.

Hydnum sulphureum Kalchbrenner.[7]

The type specimen of the species is to be found at Upsala marked in Fries's handwriting "Hydnum geogenium Fries. Upsaliae." With it are specimens collected by Lindblad at Upsala in 1857, also specimens sent by P. A. Karsten from Mustiala in 1866. All of these agree in their characters and are identical with specimens collected by C. H. Peck in New York.[8] There appears to be no doubt that the species belongs in the genus *Hyd-*

[6] It seems probable that this combination has already been made by Karsten but we have not been able to locate it.

[7] The name is cited by Fries, but we cannot find that the species has ever been described.

[8] Peck, Ann. Rept. N. Y. State Mus. **39**: 43.

nellum although the color is quite unusual and even the spores appear to be yellowish, but we have not seen a spore print. The spores are distinctly tuberculate and the substance of the plant is fibrous and tough.

No type specimen of *H. sulphureum* Kalch. has been seen, but a specimen so labelled from Kalchbrenner, collected in Hungary, was found at Upsala where it had been referred to *H. geogenium* by Fries and appeared to be identical with the type of the latter species in every respect.

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THE AGARICACEAE OF THE PACIFIC COAST—IV. NEW SPECIES OF CLITOCYBE AND MELANOLEUCA

WILLIAM A. MURRILL

Both of these genera are large and difficult, the former being characterized by decurrent or adnate gills and the latter by sinuate or adnexed gills. *Tricholoma* (Fries) Quél. is antedated by *Tricholoma* Benth., so *Melanoleuca* Pat. must be substituted for this familiar name; but combinations with *Tricholoma* are made for those desiring to continue its use.

Clitocybe albicastanea sp. nov.

Pileus convex, gibbous, at length expanded, gregarious or growing in incomplete fairy rings, 1.5–4 cm. broad; surface white, smooth, glabrous, moist, margin entire, concolorous; context thick at the center, very thin near the margin, white, without characteristic taste or odor; lamellae narrow, distant, slightly arcuate, decurrent, white, bay to dark-chestnut in dried specimens; spores ellipsoid, smooth, hyaline, 7–8.5 × 4–5.5 μ; stipe cylindric, equal, smooth, white, glabrous, solid, 3.5–5 cm. long, 3–7 mm. thick.

Type collected among leaves under oaks near Searsville Lake, California, December 28, 1902, *James McMurphy 61*.

Clitocybe albiformis sp. nov.

Pileus thick, firm, convex, cespitose, 5–9 cm. broad; surface nearly smooth, dry, glabrous, white, slightly cremeous at the center, margin entire, concolorous, strongly inflexed on drying; context thick, white, with the odor and taste of the ordinary field mushroom; lamellae distinctly decurrent, rather broad and close, several times inserted, plane or arcuate; spores globose, smooth, hyaline, 2–3 μ; stipe cylindric to ventricose, tapering upward at times, white, solid, slightly fibrillose below, finely tomentose above, 9–16 cm. long, 1–2.5 cm. thick.

Type collected in humus under redwoods near Searsville Lake, California, January 6, 1903, *James McMurphy 3*. This species

strongly suggests *Tricholoma album,* hence the specific name selected for it.

Clitocybe atrialba sp. nov.

Pileus convex to slightly depressed and at length infundibuliform, regular in outline, solitary or gregarious, reaching 6 cm. broad; surface at first smooth, glabrous, dry, fuliginous-ater, becoming finely imbricate from the breaking up of the cuticle; margin entire, concolorous, strongly inflexed on drying; context thin, white, tough, with mild flavor; lamellae decurrent, not crowded, white, becoming grayish-discolored; spores globose to subglobose, smooth, hyaline, granular, 8.5–10 × 7–8 μ; stipe equal or slightly tapering upward, flattened or twisted at times, dry, furfuraceous or finely scabrous, avellaneous, hollow, with rather tough rind, 5–10 cm. long, 6–10 mm. thick.

Type collected on decayed buried wood in the woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 259.* Also collected in the same locality, *W. A. Murrill 249,* and on decayed buried wood at La Honda, near Palo Alto, California, November 25, 1911, *W. A. Murrill & L. R. Abrams 1263.* This species is rather tough for *Clitocybe,* somewhat resembling *Collybia platyphylla.* It is characterized by its dark-brown cap, white gills, and concolorous, furfuraceous stipe. The spores are also very characteristic in size and appearance.

Clitocybe avellaneialba sp. nov.

Pileus large, thin, slightly umbonate, becoming infundibuliform, gregarious to cespitose, reaching 10 cm. or more broad; surface hygrophanous, avellaneous to dark-fuliginous, subzonate, innate-radiate-fibrillose, hispid-fibrillose in the center, margin entire, concolorous; context thin, white, of mild flavor; lamellae short-decurrent, rather close and narrow, white; spores globose, smooth hyaline, 7–8 × 5 μ; stipe tapering upward, whitish-mycelioid at the base, avellaneous, finely fibrillose to glabrous, solid or hollow with a tough rind, reaching 10 or more cm. long and 1 cm. thick.

Type collected in humus on the ground in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 526.* Also collected in humus under a log in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 293;* and among leaves and sticks under redwoods near Searsville Lake, California, January 6, 1903, *James McMurphy 2.* This species

resembles *C. atrialba* and, like that species, reminds one of *Collybia platyphylla*. It is characterized by its innate-fibrillose, avellaneous cap and glabrous or finely fibrillose stem.

Clitocybe brunnescens sp. nov.

Pileus rather thin, slightly depressed, rarely infundibuliform, reaching 4 cm. broad; surface slightly viscid when moist, smooth, glabrous, dull-avellaneous, margin entire, concolorous; context thin, whitish, with strongly farinaceous odor; lamellae decurrent, subcrowded, narrow, dull-avellaneous, becoming dark-fuliginous, especially on the edges; spores globose, smooth, hyaline, 3–3.5 μ; stipe subequal, smooth, glabrous, concolorous above, whitish-tomentose below, stuffed or hollow, 3–4 cm. long, 4–7 mm. thick.

Type collected among sticks in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 699*. This species is similar in form and color to *C. cyathiformis*, but differs decidedly in its spore characters, as well as in other important ways.

Clitocybe cuticolor sp. nov.

Pileus convex to subplane, thin, 3 cm. broad; surface smooth, glabrous, hygrophanous, dull-rosy-isabelline with a fulvous tint, margin entire, concolorous, incurved on drying; lamellae adnate, close, nearly plane, narrow, dull-rosy-isabelline; spores broadly ellipsoid, smooth, hyaline, about 4.5 × 3.5 μ; stipe eccentric, tapering upward from a bulbous base, fleshy, solid or stuffed, smooth, glabrous, rosy-isabelline, 4 cm. long, 7 mm. thick.

Type collected on the ground in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 532*. This species is colored throughout very much like the skin on the back of a man's hand. Its affinities are with *Tricholoma*, reminding one of *Tricholoma nudum*, but the gills are distinctly adnate, not at all sinuate.

Clitocybe griseifolia sp. nov.

Pileus large, fleshy, convex to expanded or slightly depressed, usually solitary, reaching 9 cm. broad; surface slightly viscid when moist, smooth, glabrous, grayish-white, avellaneous, tinted with brownish-avellaneous at the center, margin thin, somewhat lobed, slightly paler, strongly incurved on drying; context white, fragrant; lamellae rather broad and close, short-decurrent or

rarely adnate, grayish to dirty-white; spores ellipsoid, smooth, hyaline, 5–6 × 3–3.5 μ; stipe bulbous, tapering upward, smooth, glabrous, stuffed, white, 6–9 cm. long, about 1 cm. thick, 2 cm. or more thick at the base.

Type collected in humus in the woods near Seattle, Washington, October 1, 1911, *W. A. Murrill 276.* Also collected in humus in woods at Newport, Oregon, November 13, 1911, *W. A. Murrill 1088,* and on the ground at Mill Valley, Marin County, California, December 28, 1902, *Alice Eastwood 24.*

Clitocybe Harperi sp. nov.

Pileus convex to plane, subcespitose, reaching 8–10 cm. broad; surface dry, smooth, glabrous, cinereous to pale-murinous, margin entire, concolorous, inrolled; context white, taste mild; lamellae short-decurrent, of medium distance, narrow, slightly arcuate or plane, several times inserted, cinereous, sometimes with a greenish tint; spores ovoid, smooth, hyaline, 3.5–5 × 2–3.5 μ; stipe bulbous, whitish-mycelioid at the base, concolorous, pruinose, hollow, 3–7 cm. long, 1–3 cm. thick.

Type collected in Golden Gate Park, San Francisco, California, February 22, 1911, *R. A. Harper 57.* Young specimens with undeveloped spores collected in the Santa Cruz Mountains, December, 1895, *W. R. Dudley 102,* appear to belong to this category. What appears to be the same species was collected on the ground in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 637,* but the cap is avellaneous and the gills crowded and without a greenish tint. The species is similar to specimens of *T. maculatescens* Peck collected in Ohio by Morgan, but the gills are decidedly sinuate in that species and become spotted with age.

Clitocybe hondensis sp. nov.

Pileus convex, gibbous, solitary, 3 cm. broad; surface dry or moist, smooth, glabrous, subfulvous, minutely radiate-lineate, margin thin, entire, paler; lamellae decurrent, arcuate, many times inserted, close, pallid; spores ellipsoid, smooth, hyaline, 5.5 × 3.5 μ; stipe equal, crooked, whitish, smooth, glabrous, hollow, 6 cm. long, 6 mm. thick.

Type collected in rich soil under redwoods at La Honda, near

Palo Alto, California, November 25, 1911, *W. A. Murrill & L. R. Abrams 1274.*

Clitocybe murinifolia sp. nov.

Pileus convex to slightly depressed, rather thin, solitary, about 2 cm. broad; surface smooth, glabrous, smoky-brown, margin thin, slightly lobed, concolorous, inflexed on drying, pruinose when young; lamellae short-decurrent, not crowded, rather narrow, murinous; spores globose, smooth, hyaline, 2–3 μ; stipe fleshy, slightly tapering upward, smooth, glabrous, murinous, solid, whitish-tomentose at the base, 2 cm. long, 7–9 mm. thick.

Type collected on humus in the woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 300*[a].

Clitocybe oculata sp. nov.

Pileus convex to plane, slightly depressed at the center, thin, solitary, reaching 4.5 cm. broad; surface dry, smooth, finely furfuraceous, avellaneous, fuliginous at the center, margin very thin, entire, even, concolorous; lamellae short-decurrent, distant, white; spores broadly ovoid, smooth, hyaline, granular, 9–12 × 7–8 μ; stipe equal, twisted, hollow, with a tough rind, furfuraceous, whitish with a pale-avellaneous tint, 6 cm. long, 5 mm. thick.

Type collected in low woods, probably attached to buried wood, at Mill City, Oregon, November 9, 1911, *W. A. Murrill 835.* The stipe of this species is rather tough for *Clitocybe.* The species is characterized by its coloring, its furfuraceous surface, and its unusually large spores.

Clitocybe oreades sp. nov.

Pileus large, fleshy, convex, becoming plane or slightly depressed with age, usually growing in circles, 6–10 cm. broad, very thick at the center; surface smooth, somewhat viscid when moist, glabrous, shining, cinereous to murinous, sometimes covered with a whitish mold, margin entire, concolorous, deflexed when young, at times becoming upturned and more or less split with age; context thick, white, with an agreeable but not characteristic taste and odor; lamellae short-decurrent, varying to adnate, especially when young, close, narrow, arcuate, white or pale-yellowish-white; spores ellipsoid, smooth, hyaline, 6–8 × 2–4 μ; stipe very large, enlarged or bulbous below, fleshy, white or slightly cinereous, smooth, minutely tomentose or fibrillose above, solid, 10–15 cm. long, 1.5–2.5 cm. thick, reaching 4 cm. or more at the base.

Type collected in humus under redwoods near Searsville Lake, California, December 11, 1911, *James McMurphy 91.* Also collected in a similar habitat near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 280;* near Seattle, Washington, 1912, *S. M. Zeller 99, 123;* near Salem, Oregon, January, 1911, *Morton E. Peck;* in Marin County, California, December 21, 1902, *Alice Eastwood 36;* at La Honda, California, November 22, 1902, *L. R. Abrams 1.* This large and handsome species grows in conspicuous fairy rings. As the above collections indicate, it is quite widely distributed on the Pacific Coast.

Clitocybe oregonensis sp. nov.

Pileus umbilicate to infundibuliform, rather thin, solitary, reaching 4 cm. broad; surface smooth, glabrous, hygrophanous, pale-isabelline, margin thin, entire, concolorous; lamellae short-decurrent, subdistant, narrow, arcuate, discolored on drying; spores ellipsoid, smooth, hyaline, $8.5 \times 7\,\mu$; stipe fleshy, tapering upward, smooth, glabrous, concolorous, 5 cm. long, 5 mm. thick.

Type collected on the ground in mixed woods at Mill City, Oregon, November 9, 1911, *W. A. Murrill 865.* Also collected in mixed woods near Corvallis, Oregon, November 6–11, 1911, *W. A. Murrill 989.*

Clitocybe Peckii sp. nov.

Pileus irregular in outline, umbilicate to depressed, rather deeply depressed on drying, gregarious, reaching 5 cm. broad; surface hygrophanous, smooth, glabrous, grayish-stramineous, faintly radiate-striate on drying, margin thin, somewhat lobed, concolorous, becoming upturned; lamellae discolored, rather close, short-decurrent; spores ovoid, smooth, hyaline, $5–6 \times 2–3\,\mu$ stipe slightly tapering upward, concolorous, smooth, glabrous, hollow or stuffed, reaching 4 cm. long and 7 mm. thick.

Type collected in soil near Salem, Oregon, January, 1911, *Morton E. Peck 20.*

Clitocybe stipitata sp. nov.

Pileus large, fleshy, convex to nearly plane, gregarious, 8–10 cm. broad; surface smooth, glabrous, slightly viscid when moist, white, becoming cream-colored on drying, margin entire or slightly

lobed, rather thick and fleshy, concolorous; lamellae broad, crowded, decurrent, white; spores globose, smooth, hyaline, 4–6 μ; stipe equal, very long, crooked, smooth, subglabrous, whitish-mycelioid below, white, becoming reddish-brown in some specimens on drying, solid or spongy within, 15 or more cm. long, about 1.5 cm. thick.

Type collected among leaves in woods at Stanford University, California, in 1907, *Miss A. M. Patterson*. There are no notes accompanying this collection and the above description is drawn from the dried specimens.

Clitocybe subcandicans sp. nov.

Pileus convex to plane, rather thin, solitary, reaching 6 cm. broad; surface stramineous, smooth, glabrous, hygrophanous, margin white; lamellae decurrent, arcuate, close; spores globose or subglobose, smooth, hyaline, 6–7 μ; stipe cylindric, equal, concolorous, subfleshy, hollow, 6 cm. long, 5–7 mm. thick.

Type collected on the ground among fallen twigs in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 230*.

Clitocybe subinversa sp. nov.

Pileus convex, slightly depressed, rather thin, gregarious, 3–5 cm. broad; surface smooth, moist, glabrous, very light-brown, fulvous when dry, margin thin, incurved, entire, somewhat irregular, concolorous; context cream-colored, without characteristic taste or odor; lamellae decurrent, close, narrow, arcuate, many times inserted, rather firm, white; spores globose or subglobose, smooth, hyaline, 3–4.5 μ; stipe cylindric, equal, somewhat crooked, tomentose or fibrillose, subglabrous, paler than the pileus, hollow, 3–7 cm. long, 3–6 mm. thick.

Type collected in humus under redwoods at Portola, California, January 4, 1903, *James McMurphy 50*. Specimens collected at Salem, Oregon, January, 1911, by Morton E. Peck agree fairly well with this species but also closely resemble *C. sinopica*. No notes accompany the specimens.

Clitocybe subfumosipes sp. nov.

Pileus small, rather thin, convex to plane, gregarious to subcespitose, 2.5 cm. broad; surface white, smooth, glabrous, shin-

ing, avellaneous on the small umbo, margin entire, concolorous, inflexed on drying; lamellae decurrent, rather broad and distant, white, becoming discolored on drying; spores ellipsoid, smooth, hyaline, 5–6 × 2.5–3.5 μ; stipe equal, smooth, pruinose, especially above, white changing to pale-fumosus on drying, hollow, 3–4 cm. long, 2–3 mm. thick.

Type collected in humus in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 316.*

Clitocybe variabilis sp. nov.

Pileus fleshy but rather thin, plane or slightly depressed, rarely umbonate when young, gregarious, reaching 6 cm. broad; surface dry, smooth, glabrous, white, margin thin, usually entire, concolorous; lamellae narrow, usually more or less crowded, decurrent, white; spores ovoid, smooth, hyaline, uninucleate, about 6 × 4 μ; stipe tapering upward from a thickened base, smooth, glabrous, white, whitish-mycelioid at the base, hollow, reaching 6 cm. broad and 8 mm. thick, scarcely 3 cm. long in one collection.

Type collected in humus in woods, near Mill City, Oregon, November 9, 1911, *W. A. Murrill 797.* Also collected on the ground in fir forests near Corvallis, Oregon, *November* 6–11, 1911, *W. A. Murrill 897,* and in a similar locality near Salem, Oregon, January, 1911, *Morton E. Peck.* This species varies greatly in the length of the stipe and the closeness of the gills. The specimens collected near Corvallis differ so greatly from the types in these two characters as to constitute a distinct variety, which may be called *Clitocybe variabilis brevipes.*

Clitocybe violaceifolia sp. nov.

Pileus convex, somewhat gibbous, solitary, 3 cm. broad; surface slightly viscid when moist, smooth, glabrous, grayish-violet tinted with brown at the center, margin entire, slightly paler; lamellae very narrow, adnexed to slightly decurrent, rather crowded, arcuate, pale-violet; spores ellipsoid, smooth, hyaline, 7–8 × 3.5–4.5 μ; stipe equal, fleshy, solid, smooth, glabrous, grayish-violet, mycelioid at the base, 3 cm. long, 6 mm. thick.

Type collected on decaying wood near Salem, Oregon, January, 1911, *Morton E. Peck.*

Clitocybe washingtonensis sp. nov.

Pileus fleshy, convex to plane or very slightly depressed, usually gibbous, gregarious, reaching 5–6 cm. broad; surface white, smooth, glabrous, dry, somewhat shining, margin entire, concolorous; lamellae decurrent, distant, rather narrow, white to slightly discolored; spores ovoid, smooth, hyaline, 7–8 × 3–4 μ; stipe subequal, fleshy, solid or stuffed, smooth, glabrous, whitish-mycelioid at the base, 3.5–5 cm. long, 5–8 mm. thick.

Type collected in humus in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 615*[a].

Melanoleuca anomala sp. nov.

Pileus very small, plane, solitary, 2 cm. broad; surface ferruginous, dry, decorated with dense, minute fascicles of hairs, margin entire, concolorous or slightly paler; lamellae adnate to slightly sinuate, broad, not crowded, ventricose, white, becoming latericious when bruised; spores ellipsoid, smooth, hyaline, 5–6 × 3–4 μ; stipe cylindric, equal, fragile, smooth, glabrous above, fibrillose below, isabelline, solid or stuffed, 3.5 cm. long, 3 mm. thick.

Type collected in soil under redwoods at Preston's Ravine, near Palo Alto, California, November 25, 1911, *W. A. Murrill & L. R. Abrams 1198*. This species is quite different from other members of this group, its appearance indicating ferruginous rather than hyaline spores.

Melanoleuca arenicola sp. nov.

Pileus convex to subexpanded, umbonate, terraced, reaching 10–12 cm. broad; surface smooth, glabrous, ferruginous, apparently viscid when fresh, bringing up adhering particles of sand; context mild to the taste, but with a strong, unpleasant odor; lamellae sinuate, ventricose, crowded, pallid, becoming discolored with subferruginous blotches; spores globose or subglobose, smooth, hyaline, with granular contents, about 4 μ; stipe long, slightly attenuate downward, fleshy, white, glabrous, except for a few fibrils where the margin of the pileus rested against the stipe, reaching 10 cm. long, and 2 cm. thick.

Type collected in deep, pure sand in pine barrens at Newport, Oregon, November 13, 1911, *W. A. Murrill 1035*.

Melanoleuca avellanea sp. nov.

Pileus convex, becoming plane, thick, fleshy, solitary, reaching 8 cm. broad; surface dry, smooth, glabrous, avellaneous, margin entire, concolorous, inflexed on drying; lamellae slightly sinuate varying to adnate, close, narrow, arcuate, pure-white changing to yellowish on drying; spores ellipsoid, smooth, hyaline, about $7 \times 3 \mu$; stipe much enlarged at the base, rather short, fleshy, solid, white, smooth, slightly scabrous above, about 7 cm. long and 2 cm. thick, reaching 4 cm. thick at the base.

Type collected in sandy soil mixed with humus, in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 267*. Also collected on decayed wood in the same locality, *W. A. Murrill 274*.

Melanoleuca avellaneifolia sp. nov.

Pileus fleshy, rather thick, convex to expanded, gibbous, subcespitose, reaching 9 cm. broad; surface polished, smooth, somewhat viscid, dull-blackish-fuliginous, margin entire, concolorous, inflexed on drying; lamellae sinuate, ventricose, several times inserted, not crowded, pale-avellaneous; spores subglobose, smooth, hyaline, granular, about 5.5–6.5 μ; stipe equal, fleshy, solid, smooth, glabrous, pure-white, about 8 cm. long, 1.5 cm. thick.

Type collected in soil in woods at Mill City, Oregon, November 9, 1911, *W. A. Murrill 841*. Several plants were found, but only one was saved, owing to the bad weather.

Melanoleuca bicolor sp. nov.

Pileus very firm, convex to nearly plane, somewhat gibbous, about 6 cm. broad; surface dry, smooth, glabrous, avellaneous with a rosy tint, margin concolorous or slightly paler, often splitting; lamellae broad, rather close, emarginate with a slight decurrent tooth, firm, drying readily, white; spores subglobose, smooth, hyaline, 6–7 μ; stipe equal or somewhat enlarged below, white, smooth, minutely tomentose to glabrous, solid, 5–6 cm. long, about 1 cm. thick.

Type collected in humus in woods at Glen Brook, Oregon, November 7, 1911, *W. A. Murrill 745*. What appears to be the same species was collected on the ground under an oak at Mission Cañon, California, spring of 1913, *O. M. Oleson 113*[a]. These

latter specimens are very much larger than the types, measuring in the dry state as much as 10 cm. broad with a bulbous stipe reaching 6 cm. long and 3.5 cm. thick. The color is also much darker and is recorded by the collector as brown. The margin in the dried specimens is quite conspicuously striate. The typical specimens are very closely related to *Melanoleuca roseibrunnea*, but differ in color and in the shape and closeness of the gills.

Melanoleuca californica sp. nov.

Pileus convex to subplane, rather thick at the center, gregarious, reaching 15 cm. broad; surface smooth, glabrous, evidently viscid when fresh, bringing up adhering particles of soil, reddish-brown at the center, much lighter-colored at the margin, which is thin, entire and inflexed on drying; context white, rather thick at the center, thinning out toward the margin, slightly bitter to the taste, odor musty; lamellae quite narrow, less than the thickness of the context, sinuate to adnexed, plane, crowded, white, scarcely changing color on drying; spores broadly ellipsoid, smooth, hyaline, $5–7 \times 4–5\,\mu$; stipe very long, subequal, smooth, glabrous, white, solid, 10–15 cm. long, reaching 3 cm. thick.

Type collected under oaks on Jasper Ridge near Stanford University, January 11, 1911, *James McMurphy 125*. This large and handsome species resembles specimens determined as *Armillaria subannulata* Peck sent to Albany from Claremont, California, by Baker. Specimens collected by Oleson at Santa Barbara, California, apparently belong to this category, but they are rather poorly preserved and are not accompanied by notes.

Melanoleuca collybiiformis sp. nov.

Pileus broad, thin, convex to plane, drying easily like species of *Collybia*, gibbous, reaching 10 cm. broad; surface dry, smooth, glabrous, fulvous at the center, pale-fulvous near the entire, smooth margin; lamellae rather crowded, white, sinuate, the edges undulate or somewhat notched; spores globose or subglobose, smooth, hyaline, conspicuously granular within, about $3.5\,\mu$; stipe eccentric, bulbous, rather broad, fleshy, hollow, white, radicate, 6 cm. long, 1–2 cm. thick.

Type collected in humus in a grove at Woodland Park, Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 322*.

This species is closely related to some species of *Collybia*. The eccentric position of the stipe was doubtless due to the peculiar situation in which the plant grew.

Melanoleuca dryophila sp. nov.

Pileus convex, gibbous, becoming almost expanded, scattered, 3–10 cm. broad; surface glabrous, viscid when fresh, subshining, nearly smooth, whitish, stained with rusty-brown, margin paler, somewhat lobed or irregular; context white, with farinaceous taste and odor; lamellae deeply sinuate to adnexed, close, narrow, plane, white, scarcely changing on drying; spores globose, smooth, hyaline, 5–8 μ; stipe cylindric or slightly flattened, scarcely enlarged below, glabrous, nearly smooth, whitish or brownish, solid, 6–8 cm. long, 1–3 cm. thick.

Type collected in soil under live oaks at Stanford University, California, January 21, 1903, *James McMurphy 27*. This species somewhat resembles M. *subpessundata*, but differs in several important characters.

Melanoleuca farinacea sp. nov.

Pileus rather thin but fleshy, convex to expanded, umbonate, gregarious to subcespitose, reaching 8 cm. broad; surface white, smooth, glabrous, margin entire, concolorous; context white, with strong farinaceous odor; lamellae sinuate, broad, several times inserted, not crowded, ventricose, white; spores globose, smooth, hyaline, 4.5–6.5 μ; stipe bulbous and whitish-mycelioid at the base, white, subglabrous, smooth, stuffed or hollow, fleshy, 5–6 cm. long, 5–10 mm. thick.

Type collected in humus in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 644*.

Melanoleuca Harperi sp. nov.

Pileus broad, rather thin, becoming plane or depressed, gregarious or growing in circles, reaching 10–15 cm. broad; surface umbrinous, hygrophanous, not viscid, smooth, glabrous, margin entire or slightly lobed, concolorous; lamellae sinuate, white, not spotted, crowded, rather broad, ventricose, usually separating from the stipe with age; spores broadly ellipsoid, smooth, hyaline, 7–8 $\times$ 4 μ; stipe very short and thick, bulbous, solid, smooth, glabrous, white, about 3–4 cm. long, and 2–3.5 cm. thick.

Type collected in rich soil at Berkeley, California, January 31, 1911, *R. A. Harper 12.* Also collected by Harper in the same locality on February 6, 1911, and February 14, 1911. The species was found on one occasion growing in a fairy ring.

Melanoleuca nuciolens sp. nov.

Pileus convex to nearly plane, often becoming depressed and irregular with age, gregarious, subcespitose, reaching 6 cm. broad; surface glabrous, rather uneven, hygrophanous, pale-rosy-isabelline, margin concolorous, undulate to conspicuously lobed and upturned with age; context white, thin, having the odor of walnuts in dried specimens; lamellae sinuate varying to adnate, narrow, arcuate, rather distant, pale-rosy-isabelline, becoming slightly purplish-spotted when bruised or on drying; spores ellipsoid, smooth, hyaline, $6 \times 3.5\,\mu$; stipe equal or slightly tapering upward, sometimes distorted in old specimens, smooth, glabrous, pallid, hollow, almost cartilaginous, about 5–6 cm. long, 1–1.5 cm. thick.

Type collected in sandy soil in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 658.*

Melanoleuca Olesonii sp. nov.

Pileus convex to plane, large, rather thick at the center, fleshy, gregarious, reaching about 14 cm. broad; surface pure-white, smooth, glabrous, moist, margin thin, entire or slightly lobed, concolorous, not inflexed on drying; lamellae broad, ventricose, crowded, sinuate, white becoming discolored on drying; spores ellipsoid, smooth, hyaline, $7–9 \times 4–5\,\mu$; stipe short, thick, equal or slightly bulbous, smooth, glabrous, white, solid, about 4–5 cm. long and 2–3 cm. thick.

Type collected on the ground under an oak at Mission Cañon near Santa Barbara, California, spring of 1913, *O. M. Oleson 100.* Also collected February 17, 1894, *M. T. Cook 8.* The above description is drawn from dried specimens.

Melanoleuca oreades sp. nov.

Pileus becoming broadly convex or plane to somewhat depressed, large, fleshy, growing in circles, subcespitose at times, reaching 15 cm. broad; surface dry, smooth, slightly silky-striate, pale-avellaneous; context with an agreeable, nutty flavor and an

odor somewhat suggestive of skunk cabbage; lamellae slightly sinuate, crowded, narrow, white, discolored on drying; spores globose, smooth, hyaline, 4–6 μ; stipe cylindric, solid, fleshy, white or pale-avellaneous, 5–8 cm. long, 1–1.5 cm. thick.

Type collected in the edge of woods on the border of a lake near Tacoma, Washington, October 26, 1911, *W. A. Murrill 732*. Seventy-seven plants of this species were found growing there in a perfect circle thirty feet in diameter.

Melanoleuca pinicola sp. nov.

Pileus rather thin, convex, umbonate, becoming nearly plane, gregarious, reaching 5 cm. broad; surface smooth, glabrous, subshining, dry or slightly moist, milk-white, margin entire, concolorous, strongly inflexed on drying; lamellae sinuate, not crowded, rather broad, plane or slightly ventricose, white or slightly discolored; spores ellipsoid, smooth, hyaline, 5–6 $\times$ 3–4 μ; stipe slightly tapering upward, fleshy, solid or stuffed, milk-white, smooth, glabrous, whitish-mycelioid at the base, 5–7 cm. long, 4–9 mm. thick.

Type collected on much decayed, coniferous wood near Tacoma, Washington, October 20–November 1, 1911, *W. A. Murrill 730*.

Melanoleuca platyphylla sp. nov.

Pileus convex to slightly depressed, rather thick, solitary, 3.5 cm. broad; surface smooth, subglabrous, white with a cremeous tint, margin entire, concolorous; lamellae white, subdistant, ventricose, very broad; spores ellipsoid, smooth, hyaline, granular, 8.5 $\times$ 6 μ; stipe tapering upward from a swollen base, pure-white, smooth, glabrous, 8 cm. long, 5–9 mm. thick.

Type collected in humus in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 419*.

Melanoleuca portolensis sp. nov.

Pileus rather thick, convex with a prominent umbo, becoming nearly plane, seattered, 6–11 cm. broad; surface smooth, moist, glabrous, brownish-gray, darker toward the center, margin entire, concolorous; context white, with a slightly nutty taste but without characteristic odor; lamellae rather narrow, slightly sinuate, plane, several times inserted, crowded, white; spores ovoid

smooth, hyaline, 5–7 × 2.5–3.5 μ; stipe tapering upward from an enlarged base, nearly white, smooth above, somewhat roughened below, glabrous, solid, 6–8 cm. long, 1.5–2 cm. thick; veil rudimentary, leaving a trace upon the stipe.

Type collected on the ground under redwoods at Portola, California, January 4, 1903, *James McMurphy 23*. This species resembles *M. dryophila*, but differs in habitat, coloring, and spore characters.

Melanoleuca roseibrunnea sp. nov.

Pileus convex to somewhat depressed, gregarious, reaching 8–10 cm. broad; surface smooth, dry, glabrous, brownish-pink with browner circular spots, margin paler with a cremeous tint, somewhat irregular, and often upturned with age; context white, odor farinaceous, taste farinaceous with a faint bitter flavor which gradually becomes stronger, eaten by slugs; lamellae sinuate with a decurrent tooth, very close, several times inserted, white; spores subglobose to ovoid, smooth, hyaline, 5–7 × 4–5 μ; stipe cylindric, equal or at times enlarged at the base, smooth, finely tomentose to subglabrous, white or whitish, solid, 6–8 cm. long, 1–1.5 cm. thick, usually thicker at the base.

Type collected among humus on the ground in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 375*. Also collected in a similar habitat near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 237, S. M. Zeller 81;* near Corvallis, Oregon, November 6–11, 1911, *W. A. Murrill 894;* near Stanford University, California, January 4, 1903, *James McMurphy 24;* and at Pasadena, California, December 22, 1895, *A. J. McClatchie 1018*. This species is closely allied to *Tricholoma album*, but differs decidedly in color.

Melanoleuca rudericola sp. nov.

Pileus rather thin, broad, somewhat irregular, convex to plane, scattered, 10–14 cm. broad; surface smooth, glabrous, slightly moist light-buff, margin thin, entire to lobed, concolorous; context white, without characteristic odor or taste; lamellae sinuate, narrow, subcrowded, many times inserted, white; spores ellipsoid, smooth, hyaline, 5–7 × 2.5–4.5 μ; stipe cylindric, equal, scarcely enlarged at the base, grayish-white with a tinge of purple, smooth, glabrous, solid, 5–10 cm. long, 1–1.5 cm. thick.

Type collected in rich ground by a heap of rubbish at Madera Creek, California, December 21, 1902, *James McMurphy 18*.

Melanoleuca secedifolia sp. nov.

Pileus thick, fleshy, convex, not fully expanding, solitary, reaching 9 cm. broad; surface smooth, glabrous, somewhat viscid when young, pure-white, subshining, margin entire, concolorous, inflexed on drying; lamellae broad, crowded, slightly sinuate, ventricose, becoming widely separated from the stipe, white changing to dull-brownish on drying; spores subglobose, smooth, hyaline, 5–6 μ; stipe equal, much enlarged at the base, white, smooth, glabrous, solid or stuffed, 8 cm. long, 2.5 cm. thick, about 4 cm. at the base.

Type collected on the ground near Salem, Oregon, January, 1911, *Morton E. Peck 34*.

Melanoleuca striatella sp. nov.

Pileus convex and gibbous when young, becoming depressed with age, firm, fleshy, scattered, 5–7.5 cm. broad; surface smooth, subglabrous, pale-mouse-gray, very minutely striate except at the center, margin quite thick, entire, concolorous; context grayish-white with farinaceous taste, quite thick at the center, but very thin toward the margin; lamellae sinuate to adnexed, broad, plane or ventricose, close, white; spores globose, smooth, hyaline, 5–7 μ; stipe cylindric or slightly compressed, equal, longitudinally striate, whitish, solid, 3–6 cm. long, 1–2 cm. thick.

Type collected on the ground under live oaks at Stanford University, California, January, 1903, *James McMurphy 29*.

Melanoleuca sublurida sp. nov.

Pileus firm, conic to convex with prominent umbo, solitary, 7 cm. broad; surface smooth, minutely squamulose, whitish with a caesious tint, the center black, smooth, and shining, margin entire or slightly undulate, white, deflexed on drying; lamellae sinuate, plane, broad, whitish, distant; spores subglobose, smooth, hyaline, 3–4 μ; stipe subequal, dry, white with grayish, farinaceous scales, solid, about 6 cm. long, and 1.5 cm. thick.

Type collected in soil in woods at Glen Brook, Oregon, November 7, 1911, *W. A. Murrill 751*. This species is very similar to specimens of *T. luridum* sent from Sweden by Romell.

Melanoleuca submulticeps sp. nov.

Pileus large, fleshy, convex to plane, becoming depressed with age, densely cespitose, reaching 10–12 cm. broad; surface smooth,

glabrous, hygrophanous, white, margin entire, concolorous; lamellae sinuate, rather crowded, plane, pure-white; spores globose, smooth, hyaline, granular, 7–8 μ, rarely reaching 10 μ; stipe white, hygrophanous, smooth, glabrous, hollow, ventricose or enlarged below, 6–10 cm. long, reaching 3 cm. thick.

Type collected on the ground in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 659*.

Melanoleuca subpessundata sp. nov.

Pileus becoming plane or slightly depressed, usually with a conic or rounded umbo, gregarious, reaching 6.5 cm. broad; surface dry or slightly viscid, subglabrous, latericious, bay on the umbo, usually smooth, varying at times to radiate-rimose and imbricate-squamulose except on the umbo; context with a farinaceous odor and taste; lamellae sinuate, usually with a decurrent tooth, ventricose, broad, not crowded, pale-rosy-isabelline, the edges often notched; spores globose, smooth, hyaline, with granular contents, 6–7 μ; stipe slender, equal or enlarged below, smooth, pale-rosy-isabelline, glabrous above, decorated below with scattered, latericious fibrils, fleshy, solid or hollow, 7–9 cm. long, 7–10 mm. thick.

Type collected in soil in woods at Glen Brook, Oregon, November 7, 1911, *W. A. Murrill 733*. Also collected in similar situations at Mill City, Oregon, November 9, 1911, *W. A. Murrill 810;* near Corvallis, Oregon, November 6–11, 1911, *W. A. Murrill 1002;* and near Searsville Lake, California, December 11, 1911, *James McMurphy 122*. This species suggests *T. pessundatum* in its coloring, but the stipe is much longer and the spores are wholly different.

Melanoleuca subvelata sp. nov.

Pileus convex-conic when young, not fully expanding, loosely clustered; surface smooth, glabrous, moist but not viscid, latericious, leaving a stain on paper, margin entire, strongly inflexed, concolorous or somewhat paler; lamellae sinuate-adnate to adnexed, not crowded, broad, ventricose, pallid; spores ovoid, smooth, hyaline, uninucleate, 5–7 $\times$ 2.5–4.5 μ; stipe subequal to slightly ventricose, rosy, smooth and glabrous at the apex, fibrillose-shaggy near the center, fleshy, solid, 7 cm. long, about 1 cm. thick; veil scanty, fibrillose, rosy, evanescent, persisting as fibrils on the margin and stipe.

Type collected among humus under a log in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 567*. This species has a slight, rosy, fibrillose veil in young stages.

Melanoleuca tenuipes sp. nov.

Pileus small, thin, convex, not expanding, becoming very slightly depressed at the center, 2 cm. broad; surface pallid, with a stramineous or avellaneous tint, smooth, glabrous, margin entire, concolorous, incurved; lamellae sinuate-adnexed, distant, broad, several times inserted, white, more or less notched on the edge; spores ellipsoid, smooth, hyaline, 5–7 × 3.5–4.5 μ; stipe slender, equal, solid, concolorous, white at the apex, smooth, dry, glabrous, 4 cm. long, 2 mm. thick.

Type collected on the ground in woods near Seattle, Washington, October 20–November 1, 1911, *W. A. Murrill 536*. Also collected in the same locality, *W. A. Murrill 301*.

NEW COMBINATIONS

MELANOLEUCA ANOMALA	= **Tricholoma anomalum**
MELANOLEUCA ARENICOLA	= **Tricholoma arenicola**
MELANOLEUCA AVELLANEA	= **Tricholoma avellaneum**
MELANOLEUCA AVELLANEIFOLIA	= **Tricholoma avellaneifolium**
MELANOLEUCA BICOLOR	= **Tricholoma bicolor**
MELANOLEUCA CALIFORNICA	= **Tricholoma californicum**
MELANOLEUCA COLLYBIIFORMIS	= **Tricholoma collybiiforme**
MELANOLEUCA DRYOPHILA	= **Tricholoma dryophilum**
MELANOLEUCA FARINACEA	= **Tricholoma farinaceum**
MELANOLEUCA HARPERI	= **Tricholoma Harperi**
MELANOLEUCA NUCIOLENS	= **Tricholoma nuciolens**
MELANOLEUCA OLESONII	= **Tricholoma Olesonii**
MELANOLEUCA OREADES	= **Tricholoma oreades**
MELANOLEUCA PINICOLA	= **Tricholoma pinicola**
MELANOLEUCA PLATYPHYLLA	= **Tricholoma platyphyllum**
MELANOLEUCA PORTOLENSIS	= **Tricholoma portolense**
MELANOLEUCA RUDERICOLA	= **Tricholoma rudericola**
MELANOLEUCA ROSEIBRUNNEA	= **Tricholoma roseibrunneum**
MELANOLEUCA SECEDIFOLIA	= **Tricholoma secedifolium**
MELANOLEUCA STRIATELLA	= **Tricholoma striatellum**
MELANOLEUCA SUBLURIDA	= **Tricholoma subluridum**
MELANOLEUCA SUBMULTICEPS	= **Tricholoma submulticeps**
MELANOLEUCA SUBPESSUNDATA	= **Tricholoma subpessundatum**
MELANOLEUCA SUBVELATA	= **Tricholoma subvelatum**
MELANOLEUCA TENUIPES	= **Tricholoma tenuipes**

NEW YORK BOTANICAL GARDEN.

TOXICOLOGICAL STUDIES ON THE MUSHROOMS CLITOCYBE ILLUDENS AND INOCYBE INFIDA

ERNEST D. CLARK AND CLAYTON S. SMITH

WITH PLATE 91

INTRODUCTION

It had already become evident from our earlier observations that *Inocybe infida* must be considered a poisonous mushroom, both when judged by its effects on man after ingestion[1] and also from its action when injected into frogs.[2] Both the clinical data from the reported cases of poisoning and our own experimental results indicated a poison of the general type represented by the muscarin of the fatal *Amanita muscaria*. However, the usual symptoms were not produced in frogs receiving injections of the poison in *Inocybe infida*. As is the case with muscarin, the *Inocybe* poison acted more particularly upon the nervous system and seemed to be similar to the narcotic poison found by Ford[3] in the closely related *Inocybe infelix*. A more detailed study of the action of *Inocybe infida* and certain other fungi upon the *exposed heart* appeared to be desirable and in this paper we present the results of such experiments.

Increased interest in this work was stimulated by the very many fatalities, in the fall of 1911, which were caused by eating poisonous mushrooms. After the autumn rains in September of that year, the newspapers of the temperate zone of this continent and Europe contained many notices of death from this cause. In one period of ten days there were *twenty-two* such deaths in the vicinity of New York City. In scarcely a single fatal case was

[1] Murrill. A New Poisonous Mushroom. Mycologia 1: 211. 1909.

[2] Clark and Kantor. Toxicological Experiments With Some of the Higher Fungi. Mycologia 3: 175–88. 1911.

[3] Ford. Distribution of Haemolysins, Agglutinins and Poisons in Fungi, etc. Jour. Pharmacol. and Exp. Therapeutics 2: 285–318. 1911.

the identity of the fungi definitely established by a mycologist but usually the cause seemed to be either *Amanita phalloides* or *A. muscaria;* twin sisters of death, known and feared from antiquity. Many newspaper clippings from several states and countries indicate that the accidents often resulted from mistaking *Amanita phalloides* for *Agaricus campestris,* the common cultivated "mushroom," and *Amanita muscaria* for *A. caesaria,* much appreciated by a Caesar and later by somewhat reckless epicures. We have been concerned only with the less common and striking species such as *Inocybe* and *Clitocybe* but it is very desirable that all fungi having poisonous properties should be so designated and always treated with caution. With the exception of the pioneer work of Ford very little chemical and toxicological study has been given to American mushrooms.

PREVIOUS TOXICOLOGICAL STUDIES ON CLITOCYBE AND INOCYBE

These two groups of fungi had not usually been regarded with suspicion as to their poisonous nature until various observers began to report unpleasant results following their consumption. Recently, specific charges of being poisonous have been brought against *Inocybe infida* by Murrill[1] and ourselves,[2] against *Inocybe infelix* by Ford,[3] against *Clitocybe dealbata sudorifica* by Ford and Sherrick,[4] and also against *Inocybe decipiens* by the same observers.[5] In *Clitocybe illudens* Ford[3] found a poison that was fatal to guinea-pigs but not to rabbits. As an edible fungus this plant has never been popular, possibly because its phosphorescent glow at night is not reassuring. Injection experiments with frogs showed that extracts of *Clitocybe multiceps* were harmless, as was expected. In the *Inocybe infida* we separated, by muscarin isolation methods, a water-soluble substance which, after injection into frogs, caused a prolonged state of paralysis often followed by complete recovery in a day or two. The aqueous extracts of *Inocybe infelix* prepared by Ford exerted

[4] Ford and Sherrick. On the Properties of Several Species of the Polyporaceae and of a New Clitocybe, etc. Jour. Pharmacol. and Exp. Therapeutics **2**: 549–58. 1911.

[5] Ford and Sherrick. Further Observations on Fungi, etc. Jour. Pharmacol. and Exp. Therapeutics **4**: 321–32. 1913.

a powerful narcotic effect on the nervous system of rabbits and guinea-pigs, described as a profound depression lasting for hours, sometimes with complete recovery. It is evident that these two *Inocybes* contain poisonous material acting as a strong narcotic agent but not necessarily causing death. Muscarin itself does not produce the symptoms already described and the mixed poisons of *Amanita muscaria* give still another series of effects upon the organism. It is believed by many investigators that muscarin *alone* is not responsible for all of the fatal effects following ingestion of *Amanita muscaria.* Both in clinical work and in animal experiments one finds that although atropin is an antidote for *pure* muscarin it does not wholly neutralize the toxic action of *A. muscaria.* Some of our experiments indicate that muscarin may be present in other fungi like *Inocybe* and *Clitocybe* whose effects are neutralized by atropin while this was not wholly true of our extracts of *Amanita muscaria.*

EXPERIMENTAL PART

Description of Botanical Material.—All of the fungi used by us were identified and labelled for us by Dr. Murrill. Our large lot of *Clitocybe illudens* was collected near the New York Botanical Garden in the summer of 1911. The *Inocybe infida* material was also collected during the summer of 1911 on the lawns of the New York Botanical Garden. We used *Amanita muscaria* that came from Rochdale, Massachusetts, in August, 1911. Dried plants of species of *Clitocybe* and *Amanita* are large and easily handled while those of *Inocybe* are very small after desiccation and usually five or more did not weigh more than one gram. The dry fungi were ground repeatedly in a coffee-mill until a very fine powder was obtained. This powder was weighed and extracted as described below.

Description of Chemical Methods Employed.—The powdered fungi were extracted twice for twenty-four hour periods, at room temperature, with ten times their weight of 95 per cent. alcohol. The alcoholic extracts were carefully evaporated to a thick syrup which was in turn extracted with several 10 c.c. portions of alcohol. These repeated alcohol extractions and subsequent evaporations were continued until practically all of the fats, sugars and

gums had been eliminated. A final extract of the last thick syrup was made with absolute alcohol and, after this had been evaporated, the syrupy residue was mixed with powdered glass and dried in a vacuum desiccator until a yellowish, friable mass resulted. This powder was extracted with a small volume of absolute alcohol, the latter was removed from the extract by evaporation, and the small amount of yellowish waxy residue was taken up in physiological saline solution after which the traces of insoluble matter were removed by filtration. Unless otherwise noted this solution of the toxic material was used for injection or for experiments with the exposed hearts. In order to separate and purify any toxic alkaloidal material we took up the last residue from absolute alcohol with water, added a little dilute sulphuric acid and finally a solution of potassio-mercuric iodid until no more of the yellow granular precipitate formed. The details of the chemical treatment of this substance, precipitated by the potassio-mercuric iodid, may be found in our earlier paper.[6] At the final stage of this treatment the small amount of poisonous water-soluble material was dissolved in physiological salt solution and then used for the toxicological experiments. This process of alcohol extraction and alkaloidal purification was originally planned to isolate muscarin from *Amanita muscaria;* we found it to be adequate for this purpose. We also found that this same process would separate and concentrate the toxic material in *Inocybe infida* and *Clitocybe illudens.* Chemically, then, the poison in the latter forms seemed to belong to the muscarin type but that question could finally be decided only by experiments on animals.

TOXICOLOGICAL EXPERIMENTS WITH EXPOSED HEARTS

The hearts of medium-sized pithed frogs were exposed and connected in the usual way for the preparation of graphic records on a kymograph drum. In several cases the exposed hearts of turtles were used but with no appreciable difference in the type of records obtained. Solutions of the toxic material in physiological salt solution were always used on the hearts and in no case was the effect of an extract tested until we first obtained a

[6] Loc. cit.

normal tracing from the heart. The exposed hearts were kept moist with physiological saline solution and all traces of a previous test solution were washed away before adding an atropin solution, etc. To test the neutralizing effects of atropin we used a 0.5 per cent. solution of the sulphate salt of this alkaloid. Many tracings from different mushroom preparations were obtained but we shall only describe briefly and illustrate a few of the typical ones.

Experiments with Inocybe infida Extracts before Alkaloidal Purification

Experiment 6.—April 20, 1912. Weight of frog was 32 gm. After placing this solution on the heart the frequency and amplitude of the beats both decreased until a complete standstill was produced. This was overcome in a few seconds by flushing the heart with atropin solution.

Experiment 10.—May 22. The heart of a decerebrated turtle (weight 583 gm.) was exposed, treated with an *Inocybe* extract, and the effect studied. The extract in this case was much more concentrated than that used in Experiment 6 and with the turtle heart it caused a complete standstill in 5 seconds. This effect was neutralized by atropin in 10 seconds.

Experiment 4.—April 16. Weight of frog was 28 gm. The *Inocybe* extract used was the same as that in Experiment 6 and it showed the same characteristic action on this heart. See Plate 91, fig. 1.

Experiments with Inocybe infida Extracts after Alkaloidal Purification.

Some of the mushroom extracts were purified by the chemical process described and when these extracts were tested on frogs they were found to have retained their toxic properties unchanged or, more often, to have had them augmented. This would indicate that the toxic material is precipitated and purified by methods used for alkaloids and muscarin.

Experiment 24.—June 6. The frog weighed 36 gm. This purified extract was very active in causing a complete standstill

which was relieved in a few seconds by atropin. See Plate 91, fig. 2.

Experiments with the Ash of an Active Unpurified Inocybe Extract

Experiment 21.—May 29. About 15 c.c. of the extract used in Exp. 10 were evaporated to dryness and carefully ashed at low red heat, the ash was dissolved in water and tested on the heart of a frog weighing 29 gm. This solution did not produce the slightest flutter in the normal tracing and so it is evident that the inorganic or ash constituents of the fungus are not responsible for its toxic action.

Experiments with Unpurified Extracts of Amanita muscaria

Experiment 9.—May 22. The action of an *Amanita* extract was tested upon the heart of a frog weighing 33 gm. In this case a standstill of the heart was not caused although the usual retarding effect was noticed. This effect was partially neutralized by atropin.

Experiment 11.—May 23. Experiment 9 was repeated with a frog weighing 29 gm. The same slight muscarin effect appeared.

Experiments with Purified Extracts of Amanita muscaria

Experiment 26.—June 3. The action of a purified extract of this *Amanita* on a frog (weight 31 gm.) was similar to that recorded in Experiments 9 and 11 and it did not prove to be nearly as toxic as extracts of *Inocybe infida* or *Clitocybe illudens.*

Experiments with Unpurified Extracts of Clitocybe illudens

Experiment 5.—April 16. Frog weighed 35 gm. The heart was soon brought to a standstill but was started at once by atropin. The action was exactly the same as that of *Inocybe infida* but it did not take place as rapidly. See Plate 91, fig. 3.

Experiment 14.—May 23. Turtle weighed 633 gm. The turtle's isolated heart reacted to *Clitocybe* extract in a way difficult to distinguish from the response to the *Inocybe* extract.

Experiments with Purified Clitocybe illudens Extracts

Experiment 33.—June 6. Frog weighed 28 gm. The action of this purified *Clitocybe* preparation was the same as that of the unpurified extracts.

Experiments with the Harmless Clitocybe multiceps Extracts

Experiment 20.—May 29. As a control on our processes we tested the unpurified extract of this fungus on the heart of a frog (weight 33 gm.). It was found to be entirely without action. Evidently we had not been producing toxic effects through our procedures.

TOXICOLOGICAL EXPERIMENTS ON FROGS

In order to study the effect of the various fungi upon animal organisms as a whole we made injections of the different preparations into the dorsal lymph-sacs of frogs. The extracts were portions of those that were used in the exposed heart experiments; their preparation has already been described. Typical experiments with the different mushroom extracts will be given in order to show the characteristic action of each species.

Experiments with Purified and Unpurified Extracts of Amanita muscaria

Experiment 30. June 3, 1912. Frog 11 weighed 24 gm. Received an injection of 1 c.c. of *purified* extract at 5.47 P.M.

5.49 P.M. Partly paralyzed.
5.52 P.M. Wholly paralyzed.
5.56 P.M. Heart stopped.
5.58 P.M. Received injection of 1 c.c. atropin solution.
6.03 P.M. Heart begins to beat weakly and irregularly.
June 4, 9.15 A.M. Frog 11 found dead.

The results of parallel experiments with *unpurified Amanita* extracts differed in no way from those indicated above.

Experiments with Purified Extracts of Inocybe infida

Experiment 28.—June 3. Frog 8 weighed 23 gm. Received injection of 1 c.c. of this extract at 3.46 P.M.

3.48 P.M. Partly paralyzed.

3.49 P.M. Wholly paralyzed.

3.51 P.M. Heart at a standstill.

3.53 P.M. Received injection of 1 c.c. atropin solution.

3.56 P.M. Heart begins to beat slowly and it gradually resumes its normal action.

5.45 P.M. Frog 8 appears normal.

While this frog was wholly paralyzed we bared the sciatic nerve and, upon stimulation with an induced current, we obtained a normal response, thus indicating that no curare effect was present. Other experiments with *Inocybe* material gave similar results. In some cases the frogs died before the next morning; and in others, recovery seemed to be complete.

Experiments with Purified and Unpurified Extracts of Clitocybe illudens

Experiment 13. May 23. Frog 3 weighed 28 gm. Received injection of 1.5 c.c. of *unpurified* extract at 5.24 P.M.

5.28 P.M. Paralyzed.

5.33 P.M. Heart at standstill.

5.38 P.M. Tested as above indicated; there was no curare effect.

Experiment 27. May 27. Frog 9 weighed 36 gm. Received injection of 1.5 c.c. of *purified Clitocybe* extract at 12.25 P.M.

12.30 P.M. Lethargic.

12.40 P.M. Paralyzed; heart at standstill.

12.42 P.M. Received injection of 1 c.c. atropin solution.

12.50 P.M. Heart beats irregularly.

5.30 P.M. Frog 9 found dead.

CONCLUSIONS

It is evident that both *Clitocybe illudens* and *Inocybe infida* contain material exerting a characteristic muscarin effect when tested upon the exposed hearts of frogs and turtles. Furthermore, this toxic action on the exposed heart is completely overcome by the application of atropin sulphate solutions; an action analogous to that with a *pure* muscarin preparation. For some reason, parallel experiments with extracts of *Amanita muscaria*

extracts did not show the expected toxic effects nor were the latter wholly neutralized by atropin. This may be explained by assuming that this *Amanita* contains another toxic substance as well as muscarin. In fact, this theory has been advanced by other investigators to account for the results of their clinical observations and animal experiments. The lot of *Amanita muscaria* used in this work did not cause the acute muscarin symptoms which were expected from the experiments in our earlier paper. It is interesting to note that this last lot of the *Amanita* was collected in a different state and at a different time, thus giving an opportunity for both the seasonal and local variations in toxicity reported by others.

Injection experiments with *Clitocybe illudens* and *Inocybe infida* confirmed the results obtained with the isolated hearts. The toxicological evidence of all our experiments points toward muscarin as the poison in *Inocybe infida* and *Clitocybe illudens,* and this idea gains further confirmation from the fact that our methods of extraction and purification were those originally suggested for the isolation of muscarin and alkaloidal substances from fungi. Parallel experiments with the edible *Clitocybe multiceps* revealed no toxicity of any sort. The ash constituents of *Clitocybe illudens* are not responsible for its toxicity. It was necessary to test this point because it has been stated that salts of potassium produce a muscarin-like effect on the heart.[7] From our studies on *Clitocybe illudens* and *Inocybe infida* it is plain that these plants should not be eaten, since all of them contain material having a dangerous action upon the nervous system.

We wish to thank Prof. Wm. J. Gies and Prof. F. S. Lee, of the College of Physicians and Surgeons, for much helpful advice. Dr. W. A. Murrill suggested this study of poisonous fungi and our thanks are also due him for providing and identifying most of the material used.

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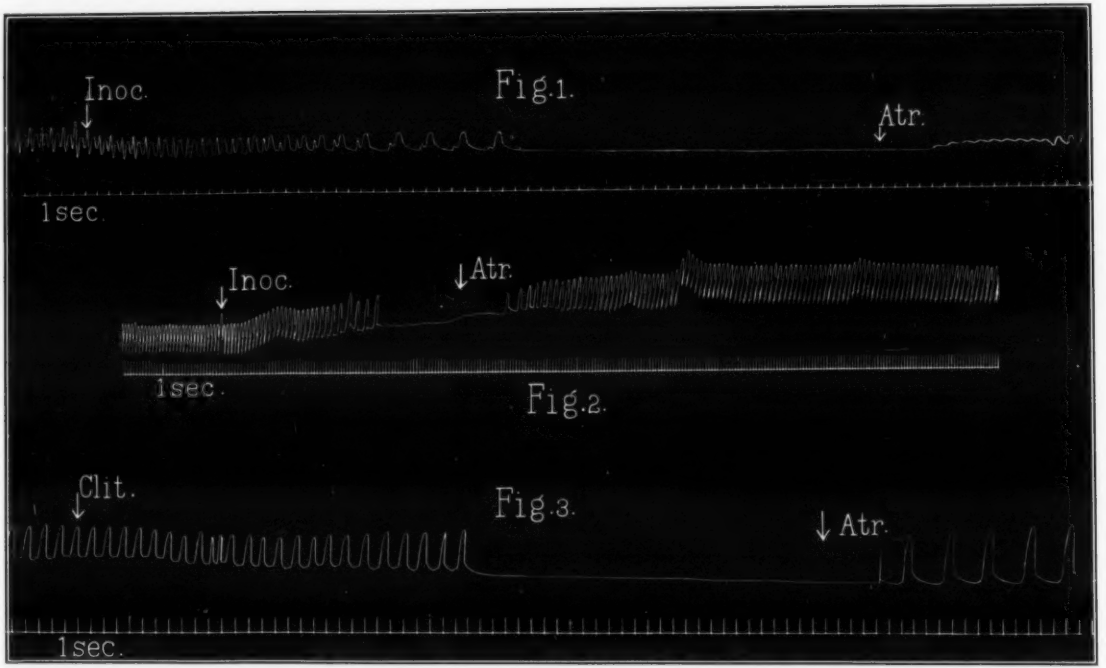
[7] Führer. Nachweis und Bestimmung von Giften auf biologischen Wege. Abderhalden's Handbuch d. Biochem. Arbeitsmethoden, V, (I), p. 77. 1912.



Graphic records of effect of mushroom extracts on frog hearts. The arrows indicate time when the various mushroom extracts and atropin solution were applied to the exposed heart

FURTHER CULTURES OF HETEROECIOUS RUSTS[1]

W. P. Fraser

Field observations extending over several years, and culture experiments during the spring of 1911, furnished evidence that the fern rusts of the genus *Uredinopsis* are heteroecious, and have their aecia on *Abies balsamea;* these aecia being the white-spored forms that have passed as *Peridermium balsameum* Peck. The infection experiments during 1911 were inconclusive, so further experiments which are described in the following pages were undertaken in 1912 to establish if possible the connection of these forms.

The teliosporic material used in all the experiments was collected near Pictou, N. S., and was wintered in the open in small cheese-cloth bags; but the culture experiments with this material were carried on in the greenhouse of Macdonald College. The plants of *Tsuga* and *Abies* used in the experiments were obtained not far distant from the college. They were taken into the greenhouse in early spring, as soon as the frost was out of the ground, and kept in the greenhouse till the young leaves appeared and the plants were in the proper stage for infection. As *Peridermium balsameum* was never collected in the field within several miles of where the plants used in these experiments were obtained, and as a number of trees of *Tsuga* and *Abies* obtained at the same time and place were kept as checks, and all remained free from infection, there seems to be no reasonable doubt that the trees used in the experiments were free from outside infection.

The writer returned to Nova Scotia about the middle of June, and the experiments with aeciosporic material were carried on in the laboratories of Pictou Academy. The ferns used in these experiments at Pictou were obtained a week or two before the ex-

[1] Read before the American Phytopathological Society at the Cleveland meeting, Dec. 31, 1912.

periments were performed. They were selected from a place remote from any known or suspected source of infection and in all cases, as described in the experiments, a number of checks were kept. The writer was thoroughly familiar with the locality, and no fern rust appeared until some weeks after the ferns were obtained, nor did any appear later on the plants surrounding those that had been selected for the experiments.

The aeciosporic material was all collected near Pictou. At the time of collection no uredinia had developed on the ferns near the trees from which it was collected or anywhere in the vicinity.

The ferns used in the experiments with the aeciosporic material were sprayed with water by means of an atomizer. The aeciospores were then shaken from the shoots on the under side of the leaves of the ferns. The shoots bearing aecia were also suspended above the ferns, and the whole was covered with a belljar for a day or two. This was done in a room separate from where the cultures and checks were kept.

The writer is indebted to Mr. E. M. Duporte and Mr. P. I. Bryce, assistants in the department, for the care of the cultures at Macdonald College during his absence, also to the Commissioners and Dr. R. Maclellan, of Pictou Academy, who in their generous way freely placed the laboratories of that institution at his disposal.

UREDINOPSIS STRUTHIOPTERIDIS Störmer

Teliosporic material of this rust on *Onoclea Struthiopteris* (L.) Hoffm. was suspended above a small plant of *Abies balsamea* (L.) Mill. on May 13. Pycnia were noticed on May 27 which probably appeared earlier, and aecia began to appear on June 1, both in great abundance, practically every leaf of the young shoots being infected. Another sowing in a similar manner on May 28 gave pycnia on June 9, with aecia showing by June 18.

Fresh aeciospores of *Peridermium balsameum* on *Abies balsamea* (L.) Mill., which were collected beside ferns of *Onoclea Struthiopteris* that were badly rusted the previous season, were sown on *Onoclea Struthiopteris, O. sensibilis* L., *Phegopteris Dryopteris* (L.) Fee and *Osmunda Claytoniana* L. on June 27.

Uredinia of *Uredinopsis Struthiopteridis* appeared on *Onoclea Struthiopteris* in abundance on June 6. The spores were oozing out on June 8. The other ferns remained free from infection. Another sowing of a collection also believed from field observation to be connected with *Uredinopsis Struthiopteridis* was made on *Onoclea Struthiopteris* and *Phegopteris Dryopteris* on June 29, with uredinia rather abundant on July 8 on the former and no infection on the latter. A third sowing of a collection similar to the others on *Onoclea Struthiopteris* and *Osmunda Claytoniana* on July 2 produced very abundant infection on *Onoclea Struthiopteris*, the uredinia appearing on July 8. Teliospores were present on July 30. *Osmunda Claytoniana* was not infected. Five pots of *Onoclea Struthiopteris* obtained at the same place and at the same time as those used in the experiments were kept as checks and remained entirely free from infection.

The place where the aeciosporic material was collected was kept under observation, and about a fortnight after the spores of *Peridermium balsameum* were being shed, the ferns of *Onoclea Struthiopteris* which grew immediately beside showed the uredinia of the rust in abundance. The distribution of the uredinia was such that it indicated the *Peridermium* on *Abies* as the source of infection.

UREDINOPSIS OSMUNDAE Magn.

Teliosporic material of this rust on *Osmunda Claytoniana* L. was placed in a moist chamber, and the teliospores germinated freely in a few days. The leaves bearing the germinating telia were then suspended above plants of *Abies balsamea* on May 26. Pycnia were observed on June 10, and aecia on June 18. Five more sowings were made and in all cases the pycnia and aecia of *Peridermium balsameum* followed. In several cases the germinating teliosporic material was placed immediately above the young shoots of *Abies* and these showed marked infection, while the other shoots remained practically free.

Observations in the field strengthened the results of the cultures. Whenever the writer found a very abundant development of the uredinia of this rust on *Osmunda* in early summer it was beneath, or close by, trees of *Abies balsamea* that showed a rich

infection of *Peridermium balsameum*. The distribution of the aecia on the trees indicated that infection had come from the rusted ferns of the previous season. These observations were made in a number of places.

UREDINOPSIS ATKINSONII Magn.

Aeciospores of *Peridermium balsameum* from *Abies balsamea* which seemed from field evidence to be connected with this rust on *Aspidium Thelypteris* Sw. were sown on a pot of these ferns on July 1, but without infection. Another sowing on July 3 of similar material gave uredinia which appeared on July 10, but not in great abundance. Three pots of *Aspidium Thelypteris* were kept as checks and remained free from infection. There was some field evidence of the connection of these forms but it was not very pronounced.

UREDINOPSIS PHEGOPTERIDIS Arthur

Teliosporic material of this rust on *Phegopteris Dryopteris* (L.) Fée was suspended in the usual way above *Abies balsamea* on May 27. Pycnia appeared on June 12 followed by aecia. Infection was not marked, only about twenty of the young leaves bearing aecia. Observations in the field also indicated the connection of these forms.

UREDINOPSIS MIRABILIS Magn.

Teliosporic material of this rust on *Onoclea sensibilis* L. was suspended above *Abies balsamea* (L) Mill. on May 13. Pycnia and aecia followed, the latter being first noticed on June 6, about a dozen leaves showing aecia.

Aeciospores (*Peridermium balsameum*) from *Abies balsamea* were sown on two pots of *Onoclea sensibilis* on June 28. Abundant uredinia followed, being first noticed on July 5, the urediniospores were oozing out by July 8.

Another sowing of aeciospores was made on *Onoclea sensibilis, Onoclea Struthiopteris* and *Aspidium Thelypteris* on July 1. Abundant infection of the pot of *Onoclea sensibilis* followed, the uredinia being present on July 8. None of the other ferns showed infection.

Another sowing on *Onoclea sensibilis* on July 3 also gave abundant infection, the uredinia appearing by July 10. Five pots of plants from the same place as those used in the experiments and obtained at the same time were kept as checks and showed no infection.

Observations in the field strengthened the evidence of connection furnished by the cultures. It was noticed for several years that wherever this rust was common on *Onoclea* in the following spring the firs near were abundantly infected with *Peridermium balsameum*, but the sequence of spore forms was not carefully observed. This season several places, where this rust was known to be common on *Onoclea sensibilis* in 1911, were kept under observation. It was found that *Peridermium balsameum* appeared abundantly on the trees of *Abies balsamea* that grew near about June 25. In about ten days uredinia appeared on the ferns of *Onoclea sensibilis* growing immediately beneath, and soon became common.

The experiments and field observations here described seem to the writer to establish the connection of the five species of *Uredinopsis* used in the experiments with the white-spored aecia on *Abies balsamea* which have passed as *Peridermium balsameum*. The question whether these are distinct species with similar aecia or whether they should be included under one species needs further study. It will be noticed that the evidence of cultures, as far as it goes, indicates that the species established are good.

The examination of the cultures and collections of the fern rusts of the genus *Uredinopsis* convinced the writer that the first spore form to appear is the urediniospore. The spores which have been regarded as aeciospores were rarely present in the collections and never appeared first.

In the genus *Hyalopsora* the aeciospores were found to be the first to appear.

PUCCINIASTRUM MYRTILLI (Schum.) Arthur

Teliosporic material of this rust on the leaves of *Vaccinium canadense* Kalm. was suspended on May 28 above a young tree of *Tsuga canadensis* (L.) Carr. Pycnia were observed on a number of leaves on June 10, and aecia began to appear on June

14. The aecia developed rapidly on about fifty of the leaves, and were mature in a few days. The aecia were the deep reddish-yellow form collected abundantly in Nova Scotia in several regions beside *Pucciniastrum Myrtilli* on *Vaccinium canadense* and *V. pennsylvanicum* Lam. which has passed as *Peridermium Peckii* Thüm. but which Arthur regards as distinct.[2]

This confirms the life history of this species as established by Clinton (Report Conn. Agric. Exper. Sta. 1909–1910, p. 719 and MS.) who sowed aeciospores from *Tsuga canadensis* on *Gaylussacia baccata* (Wang) C. Koch. and produced the uredinia of *Pucciniastrum Myrtilli.*

MELAMPSORA MEDUSAE Thüm.

Leaves of *Populus grandidentata* Michx. bearing abundant telia of this rust were placed in a moist chamber and the teliospores gave excellent germination in a few days. A sowing on two plants of *Tsuga canadensis* (L.) Carr. was followed on both plants by pycnia in about a week, and later by aecia.

On July 18, 1912, the cones of a considerable area near Pictou were found to be infected by *Caeoma Abietis-canadensis* Farl., about one half of the cones showing infection. The place was visited about ten days later and the uredinia of *Melampsora Medusae* were abundant on the leaves of *Populus grandidentata* which grew near and beneath the infected trees. These experiments and observations confirm the cultures of last year.[3]

MELAMPSORA ARCTICA Rostr.

Teliosporic material from *Salix* (species undetermined) was placed in a moist chamber until the teliospores germinated when it was suspended above *Abies balsamea* on June 10. Pycnia were noticed on June 24 followed by aecia. This experiment confirms the cultures of the previous season.[4]

[2] See Mycologia 4: 184. 1912.
[3] See Mycologia 4: 188. 1912.
[4] See Mycologia 4: 187. 1912.

SUMMARY OF CULTURES DESCRIBED IN THIS ARTICLE

1. Life histories established for the first time.

Uredinopsis Struthiopteridis Störmer. Two successful sowings of teliospores from *Onoclea Struthiopteris* (L.) Hoffm. on *Abies balsamea* (L.) Mill. Three successful sowings of aeciospores from *Abies balsamea* on *Onoclea Struthiopteris.*

Uredinopsis Osmundae Magn. Six successful sowings of teliospores from *Osmunda Claytoniana* L. on *Abies balsamea.*

Uredinopsis Atkinsonii Magn. Aeciospores from *Abies balsamea* infected *Aspidium Thelypteris* Sw.

Uredinopsis Phegoteridis Arthur. *Teliospores* from *Phegopteris Dryopteris* (L.) Fee infected *Abies balsamea.*

Uredinopsis mirabilis Magn. Teliospores from *Onoclea sensibilis* L. infected *Abies balsamea.* Three successful sowings of aeciospores from *Abies balsamea* on *Onoclea sensibilis.*

2. Life histories supplementing previous work.

Pucciniastrum Myrtilli (Schum.) Arthur. Teliospores from *Vaccinium canadense* Kalm. infected *Tsuga canadense* (L.) Carr.

Melampsora Medusae Thüm. Teliospores from *Populus grandidentata* Michx. infected *Tsuga canadensis* (L.) Carr.

Melampsora arctica Rostr. Teliospores from *Salix* infected *Abies balsamea* (L.) Mill.

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UREDINALES ON CAREX IN NORTH AMERICA

J. C. Arthur

In the systematic work on Uredinales in the North American Flora, a monographic treatise, every entry is based upon a collection in the author's herbarium, either an original one, or some data to represent a collection in another herbarium. Whatever advantage in fundamental accuracy is secured in this work probably depends largely upon the application of four tests which are the foremost guides used in systematically placing every collection: (1) life cycle, so far as direct or collateral evidence can be found; (2) name and systematic position of host; (3) microscopic characters of sorus and spores; (4) the limitation of a species in view of the influence of host and possible occurrence of races.

It has not been many years since most collections of *Carex* rusts were largely labelled "*Puccinia Caricis*" or "*P. caricina*" and said to be on "some species of sedge," or on "*Carex* sp.," and with such material the work on the North American Flora began.

As to the first test to be applied to each collection, regarding the life cycle, *Carex* rusts may be assumed to be uniform in having their spore forms of the general character of those of *Puccinia graminis* and in being heteroecious.

As to the second test, regarding the host, slow but steadily increasing progress has been made in securing authentic determination of the hosts. All *Carex* rusts belong either to the genus *Nigredo* (having 1-celled teliospores) or *Dicaeoma* (having 2-celled teliospores). The material for the species under *Nigredo*, published about a year ago, consisted of 21 collections with leaves and stems only, and 35 other collections accompanied by more or less perfect fruiting parts. The determinations of the latter had been verified or completed by comparison with the

author's phanerogamic herbarium, although a few collections had been submitted to experts.

The *Carex* material for the genus *Dicaeoma* is now being studied. A few specimens from time to time have been sent to Dr. Theo. Holm, of Washington, D. C., for critical decision regarding the host. Feeling the great advantage in accuracy that would accrue from having all the material examined and compared under the most favorable conditions, the very generous permission of Dr. Holm to submit the full set to him was accepted, and in June, 1912, all the material being used as the basis for the study of the genus *Dicaeoma,* together with that previously used for the genus *Nigredo,* was sent, to which was added the phanerogamic set of *Carex.*

The phanerogamic collection is used as a basis of comparison, in order to detect any lapses from a probably correct naming of the host. It contains a total of 321 sheets and 133 species, wholly from North America, and includes the Olney and Bailey exsiccatae. Some of the specimens were determined by Wm. Boott and L. H. Bailey, and the Iowa material was once examined by R. I. Cratty. It is gratifying to note that Dr. Holm found occasion to change the names of only five species (nine specimens) of this phanerogamic set, all being changes to closely allied species which some authors consider segregates.

The examination and study of the mycological material was a far greater tax upon Dr. Holm's time and patience, not only because of its fragmentary condition but because the opening of mycological packets in large numbers is burdensome.

Of the material submitted, now being used for the genus *Dicaeoma,* there were 645 packets which contained no fruiting parts of the host, and such names as collectors have attached to them cannot be verified. Of these, however, Dr. Holm questions the correctness of 32, either because of the appearance of the leaves, or because the locality is outside the known range of the species.

Of the 405 packets submitted, which contained some fruiting parts of the host, the larger portion had the specific name of the host attached. From a study of this material Dr. Holm found it

necessary to change the names on 29 packets. Out of the 52 packets on which the species of the host had not been given, Dr. Holm was able to supply 34 determinations.

Altogether Dr. Holm examined 1050 packets now being used for the systematic work under the genus *Dicaeoma,* and 56 packets for that previously used under *Nigredo,* or a total of 1106. For this important and authoritative assistance in trying to render the NORTH AMERICAN FLORA as accurate as possible the writer desires to publicly extend to Dr. Holm most hearty thanks.

In the preliminary manuscript for the next rust number of the NORTH AMERICAN FLORA at the present writing (February 1, 1913) there are recognized 24 species of *Dicaeoma* occurring upon 106 species of *Carex.* These 24 species are represented by 1200 North American collections, 150 collections having been added since the material was returned by Dr. Holm in November last. Although this seems like a vast array of material for the rusts on a single genus of hosts, yet one half of the 24 species are represented by 13 or less collections each, and four by only one or two collections each, these four species being from readily accessible localities in Delaware, West Virginia, Wisconsin and South Dakota, except one which is from Guatemala. Some stress should be laid upon this situation as indicating the desirability that collectors search for *Carex* rusts more assiduously, especially for such as appear to be associated in the field with definite heteroecious aecia, and not follow the practice of a famous mycologist of a prominent university who once confessed that he usually threw away *Carex* rusts—they were so troublesome to name.

It is to be hoped that no one will be discouraged by the fact that the chances are not many for picking up one of these rarer species, taking the comparative number of collections under each species as an indication. The three most commonly collected species are one with aecia on *Aster, Solidago, Erigeron* and similar genera, now passing under several names, which is represented by 208 collections, one with aecia on *Urtica* represented by 152 collections, and one with aecia on *Ribes* represented by 146 collections. The remaining seven large species range from 86 to 18 collections each.

As this paper is intended to deal chiefly with the *Carex* hosts, nothing has been said about aecial hosts of the 24 species involved, but incidentally it may be stated that aecia belonging to 11 of these species are known, and are represented by 676 collections at the present time, for which it is hoped to secure equal accuracy in determinations by enlisting the aid of specialists.

So much as to the second test used in the rust work for the NORTH AMERICAN FLORA, the one regarding hosts, and we now turn to the third test, the one relating to microscopic characters of the fungus. It being difficult to carry in mind the minute appearance of the spores for purposes of critical comparison, as many of the collections as possible have been illustrated by camera lucida drawings made with a uniform amplification of 625 diameters. There have been 693 of the *Dicaeoma* collections on *Carex* illustrated in this way, giving 1029 individual teliospores, 937 urediniospores and 69 amphispores; while of their aecial connections 174 collections have been similarly illustrated, showing 135 individual aeciospores and 86 peridial cells, with 17 sections of pycnia more or less completely drawn.

Many of the collections have had sets of data taken regarding length and breadth of a number of spores, usually six to eight, thickness of apex, side wall and pedicel, the color, sculpturing of surface, and number and position of pores. With the *Carex* collections for *Dicaeoma* are 355 such sets of data, and with the associated aecial collections 90 similar sets of data, extended to include peridial cells and pycnia.

Regarding the fourth test applied to each collection, that of the limital characters for the species, nothing need be given in this connection, as the purpose of this article is especially to call attention to the material being used for study. It may be interjected, however, that the term species in the manuscript for the final work is generally made to include such varieties, races or physiological species as many authors prefer to distinguish by separate names.

The presentation of the above statistics will illustrate some features of the method employed in preparing the manuscript for the rust part of the NORTH AMERICAN FLORA, as other collec-

tions are treated in essentially the same way as those on *Carex*. It may also indicate to collectors the desirability of including in rust collections such parts of the hosts as best serve to permit of their independent verification or determination. Possibly some idea may be gleaned of the labor and time which such a work entails. As the completeness of the work rests upon the availability of material, it is hoped that in the interests of mycologists in general those who possess either recent or old collections of rusts may contribute duplicate sets when convenient to do so.

PURDUE UNIVERSITY,
LAFAYETTE, IND.

NOTES ON NEW SPECIES OF FUNGI FROM VARIOUS LOCALITIES

CHARLES E. FAIRMAN

1. **Pestalotia truncata septoriana** var. nov.

Supposed to be the foliicolous form of a fungus generally found on wood (*Fagus,* Corda), branches (*Populus fastigiata,* Léveillé) or on stems (*Rubus,* as var. *Rubi* Karst.)[2] Regarding the spelling of the generic name it may be noted that the genus was published by DeNotaris[2] as *Pestalotia.* I do not know who first varied the spelling nor for what reason the change was made. I suggested to Dr. Barnhart, librarian of the New York Botanical Garden, that it might have been for euphony but he gave it as his opinion, in a verbal communication, that *Pestalotia* was equally euphonious and to be preferred. Taking up the matter with Prof. Henry F. Burton, of the department of Latin in Rochester University, I obtained the following information: "Pestalotius is undoubtedly the correct Latin form for Pestalozzi. Classical Latin has no 'z' sound or 'z' character except in a few words borrowed from the Greek. The Italian 'z' or 'zz' often stands for Latin 't' or 'ti.' For example in Palazzo (palatium), Arezzo (Arretium), Firenze (Florentia), Venezia (Venetia)."

Spots circular, 1–4 mm. in diam., or irregular and 1–10 mm. in length, light-brown, surrounded by a narrow brown line, becoming paler and deciduous with age; acervuli epiphyllous, minute, punctiform, scattered and sparse, arranged like the pycnidia of some *Septoria;* spores oblong-clavate, 2–4 septate, as a rule not guttulate, not much constricted, intermediate cells dark, end cells hyaline, the upper cell broad and rounded from which protrude 2–3 cilia simple or branched, the lower cell more acute and ending in a filiform pedicel, 20–22 × 7–8 μ.

On leaves of a small shrub probably belonging to the Rubiaceae, Pueblo Viejo, Mexico, June, 1911, *Rev. H. Q. Morton.*

[1] Hedwigia. 1896, p. 48.
[2] Micr. Ital. Dec. II, p. 80.

2. **Septoria Carricerae** sp. nov.

Spots white above, brownish on the lower surface of the leaves; pycnidia minute, epiphyllous on oblong spots, scattered, black, smooth, centrally ostiolate, immersed then erumpent; spores filiform, straight or curved, acute at apices, about 3-septate, hyaline, 30–35 × 1.5–2 μ.

On leaves of *Oplismenus hirtellus* (L.) Roem. & Schult, a Mexican grass called Carricera, Pueblo Viejo, Mexico, June, 1911, *Rev. H. Q. Morton.*

3. **Sphaeropsis Coccolobae** sp. nov.

Pycnidia hypophyllous, on the midrib of the leaves, scattered, immersed then erumpent, causing round pustular elevations, through which protrude the minute black ostiola, surrounded by a few simple, straight, hyaline then purplish hairs or mycelial threads; spores hyaline at first then yellowish, on cylindric hyaline basidia, mostly obovate, at times rounded or ellipsoid, with rather thick walls and granular contents, 12–30 × 12–15 μ.

On leaves of "Uvas de la Playa," Beach Grapes, *Coccoloba uvifera,* Pueblo Viejo, Mexico, June, 1911, *Rev. H. Q. Morton.*

4. **Sphaeropsis rhodocarpa** sp. nov.

Pycnidia black, numerous, closely aggregated but not in a stroma, globose, immersed then erumpent, 150–180 μ in diam.; spores rounded, oblong or ellipsoid, rounded, at times with one end subacute, hence becoming somewhat ovate, often inaequilateral, with two large guttulae, hyaline then brown, 10–17 × 7–10 μ; basidia hyaline, cylindric, from 20 to 23 μ in length.

On fruits of Persian Yellow Rose, Lyndonville, N. Y., autumn of 1911, *C. E. Fairman. Phoma rhodocarpa* Sacc. is found on same habitat.

5. **Hendersonia hypocarpa** sp. nov.

Pycnidia minute, immersed then erumpent, with minute, slender, punctiform ostiola; spores oblong-ellipsoid to oblong-clavate, 3-septate, strongly constricted at the septa, light-brown, with conspicuous dark-brown lateral walls and septa, 10–17 × 5–7 μ.

On flower stems of Persian Yellow Rose, Lyndonville, N. Y., autumn, 1910, *C. E. Fairman.*

Differs from *Hendersonia Rosae* Kickx,[3] in smaller pycnidia, and in larger, more constricted spores, as compared with Myc. Germanica no. 420 on branches of *Rosa villosa*. Kickx, loc. cit. says "peritheces immerges, eparpilles autours des noeuds, soulevant l'epiderme qui devient bulbeux, blanc, ou noirci, par transparence et qui se dechire longitudinalement pour livrer passage a l'ostiole."

6. **Hendersonia coccolobina** sp. nov.

Leaf spots irregular, whitened; pycnidia minute, black, situated just beneath the whitened epidermis which is easily detached and through which the minute ostiola protrude; spores oblong-ellipsoid, subtruncate at apices, 2 to 4 septate not constricted, brown, 10–12 × 4–6 μ, on short, hyaline, subcylindrical basidia.

On leaves of *Coccoloba uvifera,* Pueblo Viejo, Mexico, June, 1911, *Rev. H. Q. Morton.*

7. **Phyllosticta Mortoni** sp. nov.

Spots small, 1–3 mm. in diam., circular, at first black and surrounded by indefinite red or purple discoloration of the leaf surface, then becoming whitish in the center, and in age with the disappearance of the purplish spots running into brown, discolored areas; pycnidia black, sparse, covered then erumpent, amphigenous, about 100 μ in diam.; spores oblong-ellipsoid, continuous, hyaline, 4.5–7 × 2.5–3 μ.

On leaves of Mango, *Mangifera Indica,* Pueblo Viejo, Vera Cruz, Mexico, June, 1911, *Rev. H. Q. Morton 9.*

8. **Pyrenochaeta fraxinina** sp. nov.

Pycnidia 220–330 μ diam., immersed then erumpent, globose, centrally ostiolate, with the ostiola surrounded by continuous, acute-tipped setae which are 175–350 μ long; spores basillar or allantoid, straight or curved, hyaline, granular, or at times minutely nucleolate, 7–10 × 0.5–1 μ; sporophores hyaline, rather long.

On petioles of *Fraxinus,* Lyndonville, N. Y., October, 1910, *C. E. Fairman.*

[3] Fl. Crypt. Flandr. 1: 389, Sacc. Syll. 10: 318.

9. **Coniothyrium Chionanthi** sp. nov.

Pycnidia immersed, then erumpent, superficial among the fibers of the wood, minute, dull-black; spores numerous, oblong or ellipsoid, ends obtusely rounded, simple, continuous, hyaline at first, becoming smoky or brownish, 4–7 × 3–4 μ; basidia not seen.

On a decorticated branch of *Chionanthus virginica* L., Lyndonville, N. Y., May, 1911, *C. E. Fairman.*

10. **Diplodia Akebiae** sp. nov.

Pycnidia minute, black, buried then erumpent, elevating the bark in small pustules through which the ostiola protrude, scattered, simple; spores yellowish-hyaline at first, continuous, then brown, ellipsoid and uniseptate, slightly constricted at the septum, 13–20 × 10 μ.

On small branches of *Akebia quinata,* cult., Lyndonville, N. Y., July, 1911, *C. E. Fairman.*

Basidia not satisfactorily made out as the spores were embedded in a gelatinous substance. Asci not seen.

Valsaria Akebiae Ellis & Ellis has smaller spores and occurs in clusters.

11. **Cryptodiscus araneo-cinctus** sp. nov.

Apothecia scattered, gregarious or confluent, punctiform to 0.5 mm. in diam., sunk in the wood and opening by a minute round pore, then semi-erumpent with larger, round, or irregularly oblong mouths, surrounded by radiating or arachnoid filaments, sometimes becoming bare with age, brown or the same color as the wood externally, disc pale straw-colored surrounded by a yellow or brown irregular margin, rounded or oblong in form; asci cylindric, straight, 8-spored, 80 × 4–4.5 μ, surrounded by filiform nucleated paraphyses; sporidia uniseriate, oblong fusoid, straight or curved, granular or 2–4 nucleate, appearing faintly 1–3 septate, not constricted, hyaline to greenish-hyaline, 9–12 × 1.5–2 μ.

On a fallen decorticated limb in the woods, Lyndonville, N. Y. April, 1911, *C. E. Fairman.*

LYNDONVILLE, N. Y.

NEWS AND NOTES

Dr. W. A. Murrill sailed for Europe May 31, where he will spend several weeks studying in various European herbaria.

Mr. W. H. Long, forest pathologist in the United States Department of Agriculture, spent several days at the Garden in June, looking over certain collections of fungi causing heart rot of forest trees.

Professors L. H. Pennington and Guy West Wilson have been awarded scholarships at the Garden to assist them in their work on the fungi. Mr. Pennington will continue his work on *Marasmius* and Mr. Wilson on the Peronosporales.

Dr. Chas. H. Thom recently spent several days at the Garden consulting mycological literature.

The following new species of ascomycetes are described from North American material by Dr. H. Rehm:[1] *Naevia canadica, Diatrype patella, Ombrophila limosa, Pezicula eximia and Mycosphaerella lageniformis.* The last named is from California and the remainder from Ontario, Canada.

Doctor W. C. Sturgis has recently published a second paper on The Myxomycetes of Colorado.[2] This paper contains the record of 39 species, of which 33 are reported for the first time from Colorado. Three of these are new to America and three are

[1] Colorado College Publications, science series 12: 435–454. 1913.
[2] Ann. Myc. 11: 154–155. 1913.

described as new species. The new species are: *Fuligo megaspora, Didymium anomalum* and *Enerthenema syncarpon.*

The total number of species reported in the two papers is 127. Previous to the publication of this work, few species had been recorded for the Rocky Mountain region. During a part of the time Doctor Sturgis was assisted by Professor Ellsworth Bethel who is an excellent collector and thoroughly familiar with the state.

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